DOCUMENT RESUME

ED 044 833	24	EA 003 230

AUTHOR	Piele, Philip K., Ed.: And Others
TITLE	Social and Technological Change. Implications for Education.
INSTITUTION	Oregon Univ., Eugene. Center for Advanced Study of Educational Administration.; Oregon Univ., Eugene. ERIC Clearinghouse on Educational Administration.
SPONS AGENCY	National Center for Educational Research and Development (DHEW/CE), Washington, D.C.
BUREAU NO	BR-5-0217; BR-8-0353
PUB DATE	70
CONTRACT	OEC-0-8-080353-3514; OEC-4-10-163
NOTE	341p.; CASEA Monograph Series Number 22; ERIC/CEA State-of-the-Knowledge Series Numbers 1-5
AVAILABLE FROM	Publications Department, Center for the Advanced Study of Educational Administration, Hendricks Hall, University of Oregon, Eugene, Oregon 97403 ($3.75)
EDRS PRICE	EDRS Price MF-$1.50 HC-$17.15
DESCRIPTORS	*Conference Reports, Conferences, Educational Administration, Educational Planning, Information Systems, *Prediction, *Social Change, *Systems Approach, Teacher Militancy

ABSTRACT

This volume contains five state-of-the-knowledge papers commissioned by ERIC/CEA (now ERIC/CEM) and presented at a conference sponsored by ERIC/CEA and CASEA. The authors and the titles of the papers are: Willis W. Harman, "Nature of Our Changing Society: Implications for Schools"; Richard C. Williams, "Teacher Militancy: Implications for the Schools"; Roger A. Kaufman, "System Approaches to Education: Discussion and Attempted Integration"; Marvin C. Alkin and James E. Bruno, "Systems Approaches to Educational Planning"; and John A. Evans, "Educational Management Information Systems: Progress and Prospectives." (RA)

Social and Technological Change

Implications for Education

Edited by

Philip K. Piele
Director, ERIC/CEA

Terry L. Eidell
Research Associate, CASEA

with

Stuart C. Smith
Assistant Director and Editor, ERIC/CEA

THE CENTER FOR THE ADVANCED STUDY OF EDUCATIONAL ADMINISTRATION
UNIVERSITY OF OREGON, EUGENE, OREGON

1970

CASEA Monograph Series, number twenty-two

ERIC/CEA State-of-the-Knowledge Series, numbers one—five

The Center for the Advanced Study of Educational Administration at the University of Oregon is a national research and development center that is supported in part by funds from the United States Office of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the Office of Education and no official endorsement by the Office of Education should be inferred.

$3.75

Library of Congress Catalog Number: 78-631298
Printed in the United States of America
University of Oregon Press, Eugene, Oregon
DESIGNED BY E. JOSEPH SCHNEIDER
Cover Drawn by Gregory J. Armbruster

Contents

Foreword

THE publication of this monograph represents the culminating event in a major cooperative venture begun nearly two years ago by the ERIC Clearinghouse on Educational Administration and the Center for the Advanced Study of Educational Administration. That cooperative venture was, in turn, a result of the convergence of interests of these two organizations.

In the summer of 1968, CASEA announced the adoption of a revised statement of focus and objectives. In that announcement, the Center indicated that its general objectives in the years ahead would be to develop organizational and administrative arrangements that would accommodate rapidly changing instructional techniques, strategies, and goals. A central concern underlying the adoption of that objective was the realization that rapid changes were occurring in the social forces that impinge upon the educational system of this country and in the technological means by which education is conducted. To inform those in the Center who were planning future research and development activities, it appeared necessary to assemble the best information possible regarding the nature of those changes.

At the same time, the Clearinghouse was interested in commissioning a series of state-of-the-knowledge papers to provide educators throughout the country with the latest information regarding the educational implications of social and technological change in America. Thus, the cooperative venture was undertaken.

With the advice of a number of people both within and outside the two organizations, their directors began a series of discussions regarding relevant topics to be treated in the commissioned papers. Once the topics were agreed upon, a nationwide search was undertaken to identify the leading scholars in each of the topical areas.

Eventually, those scholars were identified and contacted. All agreed to prepare papers on the assigned topics and to present those papers at a conference to which leading researchers, professors, and practitioners in the field of educational administration would be invited. The conference was held in Portland, Oregon, on December 8-9, 1969. Following the conference, the papers were refined and through publication in this monograph are being made available to those interested.

MAX G. ABBOTT
CASEA Director

Introduction

When funds became available for ERIC clearinghouses to commission state-of-the-knowledge papers, the Clearinghouse on Educational Administration was confronted with two major problems. First, there seemed to be little agreement in education as to the precise nature of a state-of-the-knowledge paper. Second, even when agreement on the nature of such papers could be obtained, the subject matter to be included in them was difficult to delineate in such a way that prospective authors would have a well-defined prescription to guide their efforts.

The more general problem—that of defining the nature of a state-of-the-knowledge paper—was confronted first in a meeting of the ERIC/CEA National Advisory Board. After considerable discussion, some basic ideas about the nature of a state-of-the-knowledge paper in the field of educational administration were agreed upon. Subsequently, a set of general specifications for ERIC/CEA state-of-the-knowledge papers was prepared.

Although these guidelines were intended primarily as a means of obtaining some consistency among the papers commissioned, it seems worthwhile to summarize them here so that those who read the papers may better appreciate the constraints placed upon the authors. The guidelines provided for division of each paper into four parts.

In preparing his paper, each author was requested to define precisely for his readers the parameters of his topic. Therefore, a brief introduction or other initial statement of the topic was required.

Although the portion of a state-of-the-knowledge paper that should

be devoted to an analysis of relevant literature cannot be exactly prescribed, a substantial amount of each paper was expected to cite and critically analyze what has been written on the topic. A brief historical perspective of the topic was also considered beneficial for readers. In most topics the literature published in the last ten years (or less) was thought to provide an adequate basis for defining, synthesizing, and projecting. Citations of documents produced prior to that period were generally to be confined to "landmark" reports that have set the stage for current thinking. A major function of state-of-the-knowledge papers underlying this guideline is that they provide an interested, professional audience with a reasonably adequate set of citations through which initial competence in the topical area may be acquired.

Probably the most difficult task facing each author was that of conceptualizing from the body of available literature some generalizations that serve to organize and integrate the bits and pieces of knowledge that bear upon his topic. The synthesis segment of the paper was to be encompassing enough to embrace the major ideas and trends supported by literature in the topic as it was initially defined and analyzed. Although the synthesis could be quite brief, it was expected to be detailed enough to provide readers with the substance of the author's conclusions about what is known.

Finally, each author was expected to project the future development of knowledge in his topic, based on his realistic assessment of current knowledge, its historical development, and the probable social context of the future. Projections were not expected to exceed a period of more than one decade.

Instead of selecting topics that range across the entire field of educational administration, the decision was made to select a general theme—social and technological change—around which all five papers could be integrated. Each paper could thus be more narrowly focused so that an indepth analysis of literature was feasible. The purpose behind the selection was that, while each paper would detail one discrete topic relevant to the implications for education of social or technological change, together the papers would provide a comprehensive view of this salient theme.

In part 1, Willis W. Harman presents a broad overview of our changing society and its implications for the future of education. Harman disavows any attempt to predict the future, and instead seeks to provide a conceptual framework for understanding the direction and nature of plausible "alternative futures" for society. Harman assumes, of course, that society does have freedom of choice in affecting its future, an as-

Contributors

MARVIN C. ALKIN
Director
Center for the Study of Evaluation
University of California,
Los Angeles

JAMES E. BRUNO
Research Associate
Center for the Study of Evaluation
University of California,
Los Angeles

JOHN A. EVANS
Senior Systems Analyst
The MITRE Corporation
Bedford, Massachusetts

WILLIS W. HARMAN
Director
Educational Policy Research Center
Stanford Research Institute
Menlo Park, California

ROGER A. KAUFMAN
Professor of Education and Communication
U.S. International University
San Diego, California

RICHARD C. WILLIAMS
Assistant Dean
Graduate School of Education
University of California,
Los Angeles

CASEA—ERIC/CEA

The Center for the Advanced Study of Educational Administration (CASEA) is one of eight educational research and development centers in the United States. Each focuses on a specific problem in education. The Center's general objective is to develop organizational and administrative arrangements for public schools that will accommodate emerging instructional techniques, strategies, and goals.

Consequently, the Center has developed five programs that are concerned with the decision process at the school district level. All five concentrate on decisions relating to instructional and curricular change.

The ERIC Clearinghouse on Educational Administration is a unit of the national Educational Resources Information Center network. It cooperates with Central ERIC in Washington, D.C., to monitor, acquire, index, and abstract documents and to publish newsletters, bibliographies, and interpretive research studies in its particular educational area.

ERIC serves the educational community by disseminating educational research results and other resource information that can be used in developing more effective educational programs.

Both CASEA and ERIC/CEA are partly supported from the United States Office of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the Office of Education and no official endorsement by the Office of Education should be inferred.

Both CASEA and ERIC/CEA are located on the University of Oregon campus in Eugene.

Contributors

MARVIN C. ALKIN
Director
Center for the Study of Evaluation
University of California,
Los Angeles

JAMES E. BRUNO
Research Associate
Center for the Study of Evaluation
University of California,
Los Angeles

JOHN A. EVANS
Senior Systems Analyst
The MITRE Corporation
Bedford, Massachusetts

WILLIS W. HARMAN
Director
Educational Policy Research Center
Stanford Research Institute
Menlo Park, California

ROGER A. KAUFMAN
Professor of Education and Communication
U.S. International University
San Diego, California

RICHARD C. WILLIAMS
Assistant Dean
Graduate School of Education
University of California,
Los Angeles

sumption perhaps not shared by some of those whom he sees on the forefront of the social change occurring in our society.

While acknowledging that not one but a range of alternative futures exists, Harman singles out two of these for analysis and comparison. The first, the "second-phase" industrial society, presupposes a relatively continuous transition from our contemporary industrialized society to a highly sophisticated technological society. The second, the "person-centered" society, assumes a significant break with contemporary society in both its institutional forms and its institutionalized values.

Since these two alternative futures represent a choice between conflicting belief and value systems, Harman examines at length the belief and value position supporting each alternative. The "person-centered" society, he suggests, appears to be supported by the new beliefs and values of humanistic psychologists and contemporary youth. The "second-phase" industrial alternative, on the other hand, appears to be in line with an orderly extension of current middle-class values.

Harman ties together the impact of social change on education by describing four overriding issues on whose outcome largely rests society's "future history." Urging his readers to be aware of the possible consequences of plausible alternative futures for our society, Harman reminds educators particularly to be aware of their role in helping to choose the future.

If Harman can be said to take a macroview of social change, a microview is provided by Richard C. Williams in part 2. Williams begins with an analysis of internal and external conditions contributing to the rise of teacher militancy in the public schools. Internal conditions are the changing composition of the teacher labor force, the inadequate compensation of teachers, and the lack of agreement among teachers and school managers on the teachers' claim for "professional" status. External conditions are the growing acceptance of civil disobedience techniques, the success of the American labor movement, and the increasing public dissatisfaction with the schools.

Following this analysis, Williams describes three alternative models for improving the involvement of teachers in the decision-making process.

The *modified hierarchical* model is an attempt to alter the traditional framework for governing the schools by expanding consultation between teachers and management. The *academic* model, borrowed from higher education, delegates appropriate portions of the decision-making process to teachers. The *union* model, patterned after the labor movement in the private sector of the economy, provides for the negotiation of differences

between teachers and school managers to arrive at mutually written contracts that cover the entire operation of the school.

Williams evaluates the projected effectiveness of each model if applied to the unique problems of public education. Two such problems are the difficulty in measuring educational output and the lack of consensus as to who—the parent or the student—is the client of the public schools.

Predicting increased use of the union model, Williams assesses the consequences of this model for conflict management, organizational flexibility, and decision-making structure in the public schools.

In part 3, beginning the technological section of the monograph, Roger A. Kaufman seeks to promote a common understanding among administrators as to the uses of the system approach in solving educational problems. Kaufman defines a system approach as the application of formal problem-solving tools and techniques for effectively and efficiently achieving a desired outcome. The system approach, according to Kaufman, involves a six-step problem-solving procedure: (1) problem identification, (2) specification of main goals and subgoals, (3) identification and selection of alternatives for achieving goals and subgoals, (4) design and implementation, (5) evaluation, and (6) required revision.

In the development of the system approach, a number of techniques have been derived, says Kaufman, that have much to offer in the quantitative improvement of educational outcomes. These techniques include needs assessment, system analysis, behavioral objectives, PPBS, methods-means selection, network-based management tools, and refined testing and assessment methods.

Kaufman predicts that integration of the several system approaches will occur as confusion over terminology diminishes and as the concepts become increasingly defined in operational terms. As educational administrators become more outcome or product oriented, they will view education as an accountability system in which each person concerned has a role to play in achieving these outcomes.

Marvin C. Alkin and James E. Bruno, in part 4, discuss applications of systems approaches to educational planning. Alkin and Bruno focus on that aspect of planning primarily concerned with internal decisions in education, i.e., decisions that involve making choices among alternatives, methods, media, and technologies. According to the authors, a systems approach is composed of five major elements: objectives, alternatives, costs, a model (or models), and a decision rule. The continuous cycling of these five elements, say the authors, is the key to successful application of a systems approach to educational decision making.

Various systems planning techniques, all employing the five basic elements of a systems approach, are described and their application to education reviewed. These systems planning techniques include operations research, PPBS, systems analysis, simulations, operational gaming, Delphi technique, program evaluation review technique (PERT), and critical path method (CPM).

Although Alkin and Bruno acknowledge the existence of some major limitations to current use of these techniques in education, they nonetheless anticipate that the future will not only bring a solution to these problems, but an enormous increase in the use of systems approaches in educational planning.

Since a systems study is only as good as the data it employs, part 5 of this collection, by John A. Evans, on educational management information systems, is an appropriate conclusion to the technological section of the monograph.

Intending to contribute a better understanding of computer-based management information systems (MIS) and their implications for educational management, Evans defines and clarifies major terms and concepts relating to MIS. In a review of landmark developments in the evolution of information technology, Evans emphasizes the rapid growth of the computer as a data-management aid.

Based on a survey of literature on the applications of MIS tools to education, Evans shows that applications have unevenly penetrated the various management levels of the educational system. The greatest number of applications have occurred at the lower levels where managerial problems are least complex and most structured. Evans further discusses MIS applications by examining some of the major limitations that have shaped their development and inhibited their use.

In his concluding chapter, Evans summarizes likely future developments in MIS technology, emphasizing its probable impact on educational management.

PHILIP K. PIELE
TERRY L. EIDELL

Part I

Nature of Our Changing Society: Implications for Schools

Willis W. Harman

1

Introduction

THIS paper differs considerably from the usual state-of-the-knowledge report. The basic reason is that there is, in one sense, no "knowledge" of the future to report the state of. The times are too dynamic for the ordinary sort of projection of present trends to have much value.

To see why, one has only to imagine having, in 1958, a competent forecast from observable pre-Sputnik trends. It would have had dubious value in guiding educational policy during the decade that followed, since the urgent issues that faced education in 1968 were hardly discernible ten years before.

On the other hand, considerable value might have been found in an analysis that highlighted long-term educational issues and the projected consequences of alternative responses to them. Knowing these long-term issues, one might have been able, through analysis of changing demands on education, to anticipate such deviations as the post-Sputnik stress on science education, or the almost anti-intellectual counteremphasis on feelings, awareness, and personality growth that appeared in some quarters. These excesses would have been understood as temporary per-

turbations on the longer-term trend toward a new balance among the functions of education.

Or, to take another example, such analysis might have revealed the collision course between the steady movement toward the "affluent society" and the unspoken, de facto function of the schools to *differentially* educate and thus to help perpetuate a large "under class" in which black and brown minorities are significantly overrepresented. The precise form of the eventual conflict would not have been predicted, but the anticipation of it in some form might have brought some additional light to bear on policy making.

Thus, it is my endeavor not so much to cite and summarize available literature relating to the future of the society and of education, but rather to provide a framework within which that literature and future analyses may be fitted. That is to say, if the attempt is successful, the reader will be provided with a skeletal structure within which he can construct his own dynamically changing view of alternative futures and their implications for education.

As the construction of this framework proceeds, one fundamental theme will be seen to run throughout. Most analyses of the near-term future (that is, the remainder of the 20th century) pose, implicitly or explicitly, a challenge as to *whether the operative values that have served to bring us to the present point of technological and industrial development will continue to serve well in dealing with the problems created by that development.* (By the term "operative values" is meant those values that would be inferred from actions taken, not necessarily those to which we profess allegiance.) The consequences of society continuing to develop along present trends are already seen by many persons as suggesting a need for altered values. As we shall see, there is evident in modern revolutionary forces a thrust toward new operative values. Whether this thrust becomes dominant, or plays itself out as one more transient episode in history, is a key uncertainty of the future.

The goals assigned to the overall educational program, and hence to all of educational planning, are centrally affected by the ultimate outcome of this choice among alternative values. For this reason, the choice has been used as the most prominent component in my framework for viewing the future, or, more precisely, the available *alternative futures.* This crucial choice is particularly evident later in the chapter when two particular alternative futures are singled out for more detailed description, and when the value alternatives are related to basic philosophical premises.

In chapter 2, I examine some of the major trends identified in extant surmisings about the next three decades. By no means is there consensus

among forecasters as to the success we are likely to have in solving some of the perplexing social problems ahead. However, almost all analysts admit to the seriousness of those problems. A significant body of opinion supports the proposition that new technological remedies are not adequate treatment for technologically spawned problems, and that changes in values are essential to a satisfactory outcome.

A different look at these same data is taken in chapter 3. Among the various "alternative futures" that are implied in the differing projections of assorted futurists, two are compared. One of these assumes the basic operative values of the decades ahead to be more or less the same as in the decades just left behind; the other postulates a rapid and drastic shift. Although the future is likely to be neither one extreme nor the other but somewhere in between, the comparison serves to highlight the issues involved.

It is a fundamental concept in cultural anthropology that significant differences between cultures are essentially differences between commonly held or dominant basic ideas and standards. Similarly, alternative future states of the society represent, in some sense, alternative dominant belief-and-value systems. This point of view is examined in chapter 4.

In the fifth chapter I examine the contemporary revolutionary forces in society and attempt to provide a schema for making sense out of the rapidly developing events on this stage. Numerous partial explanations are examined for the rebellion of youth and the sequence of revolutionary acts in the sixties.

Since these explanations, either individually or when combined, seem unconvincing and inadequate as interpretations of the total scene, the possibility of an underlying conceptual revolution, as yet dimly perceived, is put forth in chapter 6. Here is examined the hypothesis that today's perplexing revolutionary activities may be usefully interpreted as indicators of a subtle changing of the basic premises of our culture, comparable in potential impact to the Protestant Reformation. The main point in such a comparison is that if such a transition is taking place, better understanding of it may reduce our anxieties and help in the rational formulation of policies that will contain those subversive forces that have to be contained, while minimizing the violence of "religious wars" that might accompany the change.

Chapter 7 is a summary that attempts to extract from the trends, alternative futures, value conflicts, and revolutionary forces, a set of issues on which appear to hinge the most significant future-determining choices ahead. Typically, such a social "choice"—take, for example, the national commitment to some form of social security—is only to a very limited

extent a consequence of the conscious decisions of designated policy makers. It also involves multitudinous minor decisions made by persons of lesser prominence, many of whom are not conscious of having made a choice at all. Yet how the society as a whole moves with regard to these overriding issues will profoundly affect its "future history."

Finally, in the last chapter I suggest some of the implications of the foregoing for schools. Analyses of alternative future states of this society have two major uses for educational planners. In the first place, since even the near-term future can, at best, be only crudely known, plans need to be examined not only in the context of what is considered to be the most likely future, but also for compatibility with other plausible futures. Second, through study of alternative futures we can see more clearly the role of education in helping to determine which of the possible alternative futures actually comes into being.

2

Apparent Long-Term Trends

As Kahn and Weiner have noted (1967), a "basic, long-term, multifold trend" of society may be observed that provides a useful baseline against which to contrast alternatives. This trend is not a prediction, but more like a mean of likely alternatives. More or less general agreement is found among forecasters with regard to the major components of this central trend as summarized below.

Economic-Political

Worldwide industrialization and modernization. The preponderant trend in the sense of forming a background for all else in the political and economic realms is undoubtedly what Robert Heilbroner (1963) terms "The Great Ascent": the continued industrialization and modernization of the entire world, and particularly the attempt to accomplish this for the largely tropical belt of underdeveloped areas.

The necessity of a shift from a parochial to a "one-world" view of "Spaceship Earth" hardly needs defense. One is frequently reminded of the need for this new viewpoint by awareness of the speed with which

news of local events is communicated around the world, to be received and reacted to almost immediately. Ecological problems are world problems. Production/distribution and communication/transportation systems are essentially global. They require, and depend on, the resources of the entire planet and, more importantly, the global interchange of research, development, and technical and managerial expertise. Most significantly of all, perhaps, political and economic problems are no longer "local." Political events in remote lands, famines or other catastrophes in underdeveloped countries, all have direct and immediate impact on the technologically developed world.

On this one-world stage the dominant event is the Great Ascent.

> The process of economic development . . . visible throughout the newly awakened areas . . . is a worldwide struggle to escape from the poverty and misery, and not less from the neglect and anonymity, which have heretofore constituted "life" to the vast majority of human beings. It is not mere rhetoric to speak of this attempted Great Ascent as the first real act of world history. Certainly in size and scope it towers over any previous enterprise of man. . . . (It) is not merely a struggle against poverty. The process which we call economic development is also, and in the long run primarily, a process through which the social, political and economic institutions of the future are being shaped for the great majority of mankind. On the outcome of this enormous act will depend the character of the civilization of the world for many generations to come, not only in the poor and struggling nations, but in the rich and privileged ones as well. (Heilbroner 1963, p. 9)

The economic development of the world will almost surely not be accomplished smoothly and according to plan. The process is likely to be marked by profound "revolutions of rising expectations," disharmony, and social discontent. The almost inevitable gaps between expectations and accomplishments may well breed political authoritarianism and economic collectivism. The jump in educational attainment from a tradition-bound peasant society to a modern industrial one is immense. Strong infusions of knowledge as well as capital will be required if the underdeveloped world is to succeed in this ambitious attempt.

Institutionalization of change. Emergent change, not homeostasis, is the order of the day. The trend is toward institutionalization of the process of research-development-innovation-dissemination, and toward the development of organizational forms adapted to promoting change.

Emergence of a "knowledge society." Drucker (1968) describes the growing emphasis on knowledge in detail. The emerging society is based on knowledge as the central capital, with educational and "intellectual" institutions playing a key role (Bell 1967). Demand grows for skilled,

semiprofessional laborers, and diminishes for unskilled, uneducated laborers. Some writers have speculated about the future problem of increased leisure as a consequence of the cybernated society. More likely is the prospect of a 40 (and more)-hour week for the "knowledge workers" and unemployment for the untrained. There will be an expanding portion of the populace involved in education and an increasing percentage of the national income going to education. There will also be an increasing involvement of education with other social institutions.

Scientific-Technological

Accumulation of scientific and technological knowledge. The one forecast on which practically all analysts agree is that of an increasing level of applied scientific knowledge and an increasing degree of cybernation. Kahn and Weiner (1967) list one hundred likely technical innovations, and Chase (1968) describes the society that may result.

Increasing lag of technological solutions behind technology-created problems. Examples of problems created by technology abound. Increasing industrialization creates problems of resource depletion, fouling of the environment, waste disposal, technological unemployment, congestion, and assorted urban ills, problems that show no sign of doing anything but increasing. Medical advances are largely responsible for the dramatic rates at which the world's population increases, leading to overpopulation and food supply problems. Advances in the production of weapons and their delivery systems have brought us to the threshold of an internecine conflict that resembles some of the nightmares of yesterday's science-fiction writers.

Robert Heilbroner (1960) points out that the "new forces" generating problems in the nation are essentially extensions of three main currents of American historical development, namely, rampant scientific and technological development, extension of opportunities to the underprivileged, and increasing social control over private economic life. Those same currents are likely to continue, and so are the problems.

Social-Ecological

Increasing problems of ecological balance, environmental deterioration, population concentration, and food supply. There is no indication that any of these problems will do other than get worse in the years immediately ahead. A drastic shift in values to supplement regulatory action seems necessary to reverse the trends toward increasing ecological imbalance, pollution of air, water, and soil, and nuclear and agrichemical

contamination. Although we hear brave talk of solutions to population and food problems through such means as new methods of contraception, floating cities and undersea communities, increased yield by crop breeding, and farming the oceans and coastal deserts, most projections indicate that at best these measures will only afford temporary relief.

Increasing affluence, with increasing self-consciousness of the under class. The worldwide trend toward increasing per-capita income will continue, but with a more rapid rise in the industrialized countries, thus increasing the gap between have and have-not groups. Both in this nation and around the world, increasing pressure to redress the imbalance can be expected from the have-nots.

Growth of a "knowledge elite." Trends toward increasing bureaucratization and toward knowledge as power, taken together, suggest the development of a meritocratic, "knowledge power elite." Bell (1967) goes so far as to predict that "not only the best talents, but eventually the entire complex of social prestige and social status, will be rooted in the intellectual and scientific communities" (p. 30).

Increasing interdependence of social and political institutions. Partly in response to the world problems described above, we can expect a continuation of the trend toward limited-purpose international organizations and corporations (together with attempts—probably unsuccessful—to move further in the direction of a strong United Nations). Movement will also continue toward recognition, in institutional forms and practices, of the interlocking nature of economics, technological development, education, health, and the social order.

Within the United States, the trends toward greater urbanization and industrialization will continue, and with them such associated problems as urban decay, technological unemployment, congestion, poverty concentrations, crime, and accumulation of waste products. These problems, in turn, contribute to pressure for increasing social control, increasing pluralism of institutional power (with ethnic, economic, and age minc groups insisting on representation), and increasing meshing of the activities of local, state, and federal government agencies, business corporations, and nonprofit institutions. Detailed central control may be replaced by generalized central control, with local units being given responsibility to make specific decisions in carrying out the broad policies.

Cultural-Psychological

Increasing proportion of growth-motivated persons. Past trends of increasing affluence, increasing levels of education, and changing child-

rearing patterns combine to indicate that an increasing fraction of the population will be, in Maslow's terms, "growth motivated" rather than "deficiency motivated." This shift is showing itself in the higher values placed on the feeling and subjective side of life, on self-realization, and on finding meaning and significance in work. There is also, in addition to more questioning of traditional work values, a tendency to blur the distinctions among work, leisure, and education.

Increasing stress-producing forces on the individual. Sources of stress include continuing international and domestic tensions, fear and hostility in the cities, rapid obsolescence of job skills, increasing complexity of the individual's network of interpersonal relations, and instability and change in life patterns. A major product of these stresses will be fear—fear of change, fear of powerlessness, fear of loss of privacy and independence, and fear of insecurity. This fear in turn will give rise to counterforces opposing some of the trends listed above.

"Unsolvable Macroproblems"

Standing out from these trends are two overriding problems that we might well term "macroproblems." The effects of these problems and the urgency of their ultimate solutions are worldwide in scope. They are already serious and will undoubtedly become more so. And most significant of all, there is good reason to assume that they will not be solved within the context of present operational values. The first is what Kahn and Weiner term the problem of our "Faustian powers." The second is the poverty of the masses of the underdeveloped nations, who continue to breed at a relatively high rate.

The "Faustian powers" humanity has gained through rampant development and application of technology have already brought us to the threshold of overpopulation; pollution of air, water, and soil; extensive unemployment of the unskilled; paralyzing air and surface traffic congestion around urban centers; and the threat of nuclear holocaust. These problems are the direct result of the unspoken policy that whenever technology could make a profit for an individual or an organization, or could contribute to a nation's ability to carry on warfare, the technology would be developed and applied. But now this policy has brought us to what Archibald MacLeish has called "The Great American Frustration"—the feeling that we "have somehow lost control of the management of our human affairs, of the direction of our lives, of what our ancestors would have called our destiny" (1968, p. 13).

It has become clear that we possess now, or could develop soon, the power:

- through "human engineering," to modify indefinitely the bodies of selected individuals, for reasons ranging from scientific curiosity to prolonging life
- through genetic engineering, to modify the characteristics of the human race and to shape the course of evolution
- to change at will the physical characteristics and the plant and animal population of the biosphere
- to alter at will men's mental and emotional characteristics, including intellectual abilities, motivations, personalities, and character
- through weapons of mass destruction, to annihilate large segments of the human race and to devastate large areas of the earth
- to change significantly, in many other ways, the kind of world that is passed on to the next generation

Past experience gives us little assurance that the predominantly economic values and laissez-faire policies that have thus far governed industrialization and technological development will suffice to insure that such potent powers will be used for the overall benefit of humanity. Our past practice has been to allow arms races, pollution, environmental degradation, ecological imbalance, or denuding of the land to proceed until the situation obviously became intolerable and then to attempt some sort of corrective action. This may not be good enough in the future.

Wheeler (1969) argues that some sort of control over the flow of scientific and technological innovations is as necessary now as economic controls of capital flow have been in the past. Furthermore, this control must be transitional, involving at a minimum all of the highly developed nations.

It seems clear that this "sorcerer's apprentice" problem calls for more than simply different policies. Some new institutional forms will be necessary as well. But even more may be required. In the end the issue is not one of technology but of values. The question is not one of devising managerial techniques to control technology, but rather a much more fundamental one of whether the operative values that served so well in the development of modern technology are basically capable of handling its humane application. Peccei sums up the issue as follows:

> The ambivalence, ambiguity and unpredictability deemed to be linked to technology are man's. Whether the sum total of its effects will eventually be disruptive beyond repair, or fruitful beyond hope, de-

pends essentially on him. . . . Villain or savior, perverter or healer—technology will just play the role man assigns to it. But one thing is not possible: that man may himself go on (irresponsibly) playing with the tremendous force of technology. He can no longer remain an apprentice sorcerer. He has to master his technology. What he must realize is that his function has changed. As Julian Huxley said, "His role, whether he wants it or not, is to be a leader of the evolutionary process on earth and his job is to guide and direct it in the general direction of improvement." (1969, p. 135)

The second "unsolvable macroproblem" centers around the tendency for the gap between industrialized and underdeveloped nations to widen in spite of deliberate programs aimed at closing it. This problem has resulted from a combination of two powerful factors: the self-perpetuating acceleration of technological and industrial development in the prosperous nations, and the staggering problems in the overbreeding and underdeveloped societies. In the latter countries, where the major impact of modern science has been to lengthen the average breeding period and to upturn dramatically the population-growth curve, population is doubling in a generation or less. Merely to maintain their current inadequate standard of living requires more than their available capital resources allow. They have little industry, lack a sufficient force of trained teachers, technicians, and managers, and need to make up enormous arrears in food production, education, road building, housing, and sanitation.

Ethical considerations aside, the existence of this growing disparity in quality of life poses a constant threat to world stability.

> Extreme poverty, when combined with ignorance, breeds . . . the resigned acceptance of a subhuman lot. But extreme poverty, when it is combined with the knowledge that some societies are affluent, breeds envious desires and the expectation that these desires must of necessity, and very soon, be satisfied. . . . By means of the mass media some knowledge of what life is like in affluent societies has been widely disseminated throughout the world's underdeveloped regions. . . . In the context of a three, or even of a two, percent annual increase in numbers, high expectations are foredoomed to disappointment. From disappointment, through resentful frustration, to widespread social unrest the road is short. (Huxley 1969, p. 16).

Again the immensity and complexity of the problem are sobering. It does not appear politically feasible, given present operative values, for the governments of the prosperous nations to contribute foreign aid that is at all of the magnitude required to bring these nations to the "takeoff point." As regards the private sector, the rationale of the profit motive tends to limit severely the investment in human capital, since the returns

would be a long time in coming. Without this human development, it will continue to be more profitable for business to invest in European and American affluence, rather than in Third-World poverty. Thus, the prospects for the underdeveloped countries are dim, yet the potential costs of failure to solve the world's poverty problem are frightening to contemplate.

Again the question is whether the values that served well enough to guide isolated villages, or even isolated continents, will suffice to guide a single integrated planet. If they will not, then this is the most important single thing to know in designing the education of the future. For if values are to be changed, they must be changed through an educative process.

3

Two Contrasting Forecasts

Confronting the decades immediately ahead, I am tempted to paraphrase Charles Dickens as he opens *A Tale of Two Cities*: It will be the best of times, it will be the worst of times, it will be the spring of hope, it will be the winter of despair. Within the forecasts from which the "basic, long-term, multifold trend" was extracted are to be found a broad range of portrayals. At one extreme are descriptions of the utopian benefits of technology relieving man once and for all of concern over supply of human wants, providing unlimited leisure and universal education, and fostering democratic freedom and equality such as only a high-technology, affluent society can do. At the other extreme are dire predictions of uncontrollable fouling of the planet, reduced privacy and political significance of the individual, and widespread overpopulation, poverty, famine, and civil disorder. What sort of order can we bring out of this divergent prophesying?

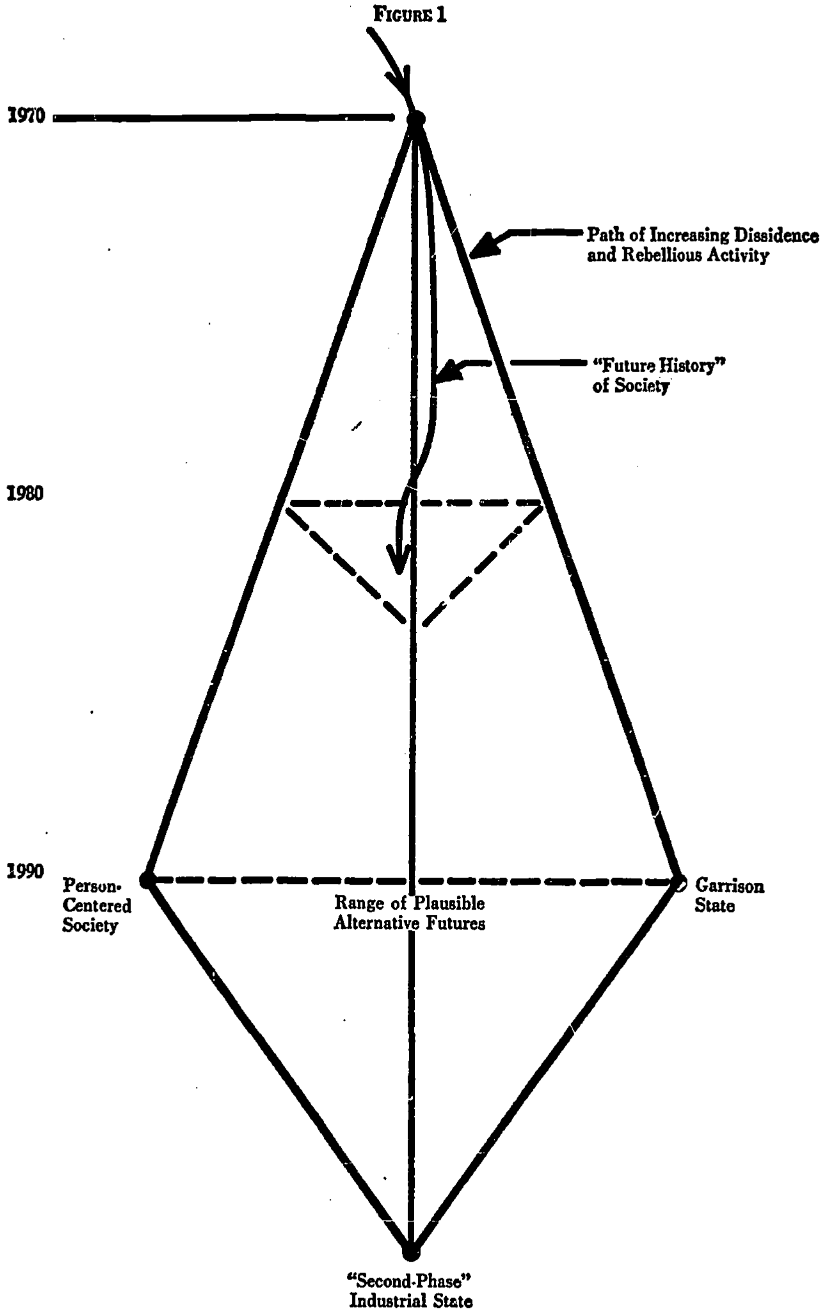
Since we cannot know the future, and in fact must proceed under the assumption that we have some freedom of choice in affecting the future, we can most profitably speak not of *a* predicted future, but of a range of

plausible *alternative futures*. Figure 1 is an attempt to show the concept diagrammatically. If the level of dissidence and rebellious activity continues to rise, and with it the level of counteractive repression, it is conceivable that we might move toward a garrison state by, say, 1990. On the other hand, if society were to alter drastically its values so as to place priority on fulfillment of human potentialities, we may as easily have reached a "person-centered" society by 1990. However, if the "basic, long-term, multifold trend" is extrapolated, we arrive, more or less, at what might be termed a "second-phase" industrial state. The general idea depicted in the diagram is that the actual "future history" of the society will probably not be a straight-line path to one or another of the extreme possibilities, but rather will be a wavering pathway to some mediate state.

At the everpresent risk of oversimplifying to the point of distortion, I will compare two of these alternative futures, for, say, the last decade of the century: the "second-phase" industrial society and the "person-centered" society. A fair description of the former can be obtained from a weighted summation of the many trend projections, Delphi forecasts, and brave-new-world predictions that abound in technical and popular literature. (It is similar, in its basic concept of extrapolation of present trends, to "The Most Probable World" of Chase [1968].) The "person-centered" society, on the other hand, is a composite picture based on the views of a group of writers and analysts who assume (or hope) that a rapid change to some kind of "posteconomic" institutionalized values will take place. This group includes, among others, John Kenneth Galbraith, Michael Harrington, Erich Fromm, John Rader Platt, Kenneth Boulding, Robert Theobald, and Abraham Maslow.

These two futures are not presented, even by their proponents, on an equal basis. The first assumes a relatively continuous transition from the "first-phase" industrial society, which has so far lasted from the Industrial Revolution to the present, to the "second-phase" computerized, cybernated state. Implicit in this transition is the further assumption that such trends as the expanding economy and the advancing technology have, so to speak, a life of their own. That is, once set in motion, their own dynamic nature carries them forward. Thus it is appropriate to project them into the future and to ask such questions as, "What effect will increased knowledge in bioengineering have on human values?" To be sure, the advance of technological achievement will bring with it such new social problems as industrial pollution, poisoning by agrichemicals, encroachment on privacy, traffic congestion, and threat of nuclear destruction, which are our present heritage. But these problems, in turn,

Figure 1


1970
Path of Increasing Dissidence and Rebellious Activity
"Future History" of Society
1980
1990
Person-Centered Society
Range of Plausible Alternative Futures
Garrison State
"Second-Phase" Industrial State

will be "solved" by still higher technology as the "second-phase" industrial state is realized.

The second forecast, the "person-centered" society, assumes, by contrast, a significant discontinuity with past trends. Its proponents tend to view our present time of troubles as a transition period to a state radically different from the present, both in institutional forms and in institutionalized values. The level of technological development would be comparable with (or somewhat lower than) that in the first forecast, but the uses to which technology would be put might differ significantly. The value shift would be in the direction of a more "person-centered" culture. Critics of this forecast would say it is unrealistic; critics of the first forecast would say it is undesirable, if not self-destructive.

In both of these forecasts we can assume that certain trends and developments are here to stay, at least for the near future. One is a high and increasing level of technology and cybernation. Another is the conduct of most purposeful activities by large-scale centralized organizations, such as those developed in government and industry in recent decades. Further, the distinction between public and private organizations will no doubt become further blurred, as it already has in military procurement, space exploration, and atomic energy. Planning will tend to replace the market mechanism in controlling the flow of money.

The "Second-Phase" Industrial Society

In the "second-phase" industrial society, cybernation will have taken over, and will do better, many of the tasks for which men's minds are presently trained. Those who are leading exciting lives at the managerial or technological forefront of the advancing society will probably work as many hours as at present. For the rest there will be increased leisure to be used for recreation or education. On the whole, there will be more years of education per person and a near-100 per cent literacy rate.

Research and services will play a more dominant role, production less. "Intellectual institutions" (universities, research laboratories, "think tanks," systems-analysis centers, etc.) will play a more significant role. Change—the research, development, and innovation process—will be institutionalized. That is, institutions will be facilitators of change rather than impediments to change. These developments will result in the growth of, and concentration of power in, a bureaucratic and knowledge-based "meritocratic" elite. A highly professional and intellectual class, this elite will comprise a network linking the widespread governmental, military, university, research, policy-analysis, urban-development, financial,

commercial, and industrial organizations. Highly centralized and intensive (though possibly subtle) social control will be wielded over vocational training, worker mobility, work attitudes, and consumer habits.

New applied technology will have affected life in many ways. New types of household devices, many based on small computers and elaborate communication services, will be available, not only transforming the life of the housewife, but also allowing education and various forms of business to be carried on in the home. Through cybernation and genetic management of plants and animals, the agricultural industry will be made many times more productive in terms of use of land and labor. Coastal desert lands will be made habitable with desalinated water. Nuclear power and fuel cells will provide ample energy for all demands. Automated factories will produce practically all consumer goods, with variety programmed in to satisfy consumers. New transportation systems will have more people traveling further, faster. The housing industry will indeed have become an industry, producing new types of improved housing with mass-production economy, yet with aesthetic and functional variety.

There will be variety in cities, too, with planned communities and specialized forms—scientific cities, university cities, festival and ceremonial cities, recreational cities, and experimental cities. Experiments with alternatives to the main patterns of living (precursors being communes, bohemian urban communities, substitutes for marriage, etc.) will be commonplace. Schools in the forms we have known will virtually disappear. Instead, education will take place via combined systems of machines and human assistants located in homes, neighborhood centers, specialized learning centers, museums, and industrial and business locations.

Along with these advantages there will be some problems. Because of the lag in modernization of underdeveloped countries, the gap between rich nations and poor nations will grow even larger. International organizations of various sorts will somehow have managed to contain the nuclear threat, and will have made great strides in fostering economic development of poor nations, but international strife and a semimilitarized economy will continue. Fed by the dynamic character of science-technology and unchecked because of failure to find any satisfactory alternative to technological approaches to international problems, the arms race will have continued to escalate.

There will be internal tension too. Although some progress will have been made on the poverty problem, the white-nonwhite conflict will continue, and the alienated young of the sixties will be raising another generation, also alienated. However, the law-enforcement agencies will have

regained the initiative; violence and counterviolence will be under control and conflict will mainly take the form of widespread subterranean resentments.

It will be interesting to speculate on the nature of these dissenting views. The dissenters will be, on the whole, at a higher level of material well-being than in the sixties, and better educated. We can imagine their criticism of the basic contradictions in the society as follows: The operative goals of the society are continuing expansion of output (goods and services), a commensurate increase in consumption, technological advance, efficient use of resources toward these ends, and furtherance of the public images that sustain all of these goals. Individual lives are to be spent in the service of these goals. Human wants rate lower than, and thus must conform to, the needs of the industrial system. State policies, the educational system, and conventional morality are all molded to fit the requirements of the system. Although the necessity to close the gap between rich and poor nations is recognized, it is uneconomical to trade freely with the latter or to invest heavily in their balanced economic development. The need is recognized to abolish the slums, poverty, and racism, and to provide the poor minority with adequate education and equal opportunity; yet it is uneconomical for private capital to do this and effective government action is opposed by threatened lower-middle and working-class whites. Humans need contact with nature and beauty, but it is uneconomical to design a humane urban environment or to provide money for parks, aesthetics, history, or civility. Although the channels of mass communication offer a great potential for public enlightenment, they are used mainly to promote sales and to distribute propaganda for business and government interests. Somehow the social system is not serving the interests of the individuals who comprise it; nothing short of a radical change in the operative values within it can alter this fact.

The "Person-Centered" Society

In the humanized technological society, it is precisely these operative values that have changed. The goals of the society include making economic growth meet human needs, achieving knowledge and aesthetic advance, and controlling social problems so that individuals may progress toward their own goals of self-fulfillment. The industrial system is subservient to, and responsible for fulfilling, these larger purposes of the society. The overarching goal is the cultivation and enrichment of all human beings, in all their diversity, complexity, and profundity.

According to the forecasts that describe this society, each individual

will be provided with enough resources, and in such a way, as to enable him to live in dignity. Underlying the economic system will be the proposition that each free man has the right to a full life of useful, rewarding work and self-development. Economic security will not be achieved solely by welfare payments or guaranteed incomes. In part, at least, it will be accomplished by extending the principle of free goods and services from those provided today (elementary education, library services, fire and police protection, innoculations, lunch milk for children, etc.) to others (re-education for a new occupation, food and nutrition staples, urban transportation, etc.). In the "knowing society" (Drucker 1968) education will be as central to the economy as mass production has been in the past. Thus, education will be a valid occupation, entitling the student to subsistence as well as the opportunity to learn. A diversity of educational paths will be available, and men will not be judged on the basis of a single uniform academic standard. (Competitive grading, therefore, will assume much less significance.) Similarly, the society will provide a diversity of ways in which a person can win the esteem of others. In other words, economic failure or academic failure will not be equated with failure as an individual.

Mumford has analyzed the basic attitude shifts that would have to accompany conversion to the "person-centered" society. There are, he says,

> serious reasons for reconsidering the whole picture of both human and technical development on which the present organization of Western society is based. . . . The deliberate expression and fulfillment of human potentialities require a quite different approach from that bent solely on the control of natural forces. . . . Instead of liberation *from* work being the chief contribution of mechanization and automation, liberation *for* work, for educative, mind-forming work, self-rewarding even on the lowest physiological level, may become the most salutary contribution of a life-centered technology. (1965)

The society will be a planned society, but planned in such a way as to deepen, not diminish, the freedom of the individual. Opportunity will be provided for real participation in planning by those for whom the planning is done. Management structures will be such that power flows both ways.

The technological level will be high, as in the "second-phase" industrial society, but the priorities for technological development will be influenced by human and global needs. The problems of the ghetto and of the underdeveloped societies will not have been completely eliminated, but their solution will have had high priority. As a consequence of these efforts

to respond to human needs, and also as a consequence of the way people perceive the goals of society, international tensions will have lessened and internal alienation will have decreased markedly. The military establishments of the industrialized nations will have moved a long way toward cooperation in an international policing role. Internally, new standards will govern recruitment and training of officials responsible for maintaining justice and order. The image of the police will be that of protector of all, with fairness and justice to everyone regardless of skin color, economic condition, or type of haircut and beard.

Education will center on developing self-learning habits and skills, problem-solving and decision-making abilities, individuality, sound valuing capabilities, capability of continuous self-renewal, and self-understanding. Education will be much more equated with life, and, as the distinction between formal and informal education becomes increasingly blurred, will be much more a lifetime activity. The significant distinctions will not be work vs. education or work vs. leisure, but work-education-leisure vs. "killing time."

Hutchins describes "the learning society" as follows:

> ... one that, in addition to offering part-time adult education to every man and woman at every stage of grown-up life, had succeeded in transforming its values in such a way that learning, fulfillment, becoming human, had become its aims and *all its institutions were directed to this end.* This is what the Athenians did. . . . They made their society one designed to bring all its members to the fullest development of their highest powers. . . . In Athens, education was not a segregated activity, conducted for certain hours, in certain places, at a certain time of life. It was the aim of the society. . . . The Athenian was educated by the culture, by Paideia. (1968)

The Athenian education was made possible by slavery, which was the necessary provider of leisure. But "machines can do for every modern man what slavery did for the fortunate few in Athens. The vision of a learning society ... can be realized.... Whether it does or not depends upon the transformation of values."

But a set of values is based, in turn, on a conception of the nature of man, his potentialities, and the possibilities for their realization. That is to say, the choice between the two alternative futures we have described is also in a sense a choice between two images of man.

4

Beliefs and Values In Transition

THUS far I have postulated that the values of society are, or may be, in transition. I observed that advancing technology has an impact on values and that, perhaps more fundamentally, values influence what technology comes into application. I also suggested that society may alter its values if it perceives that its past values are leading it into untenable situations. In the preceding section I argued further that a choice between significantly different alternative futures is implicity a choice between belief-and-value systems (Baier and Rescher 1969).

FOUR BELIEF-AND-VALUE POSITIONS COMPARED

I will now compare summary descriptions of four belief-and-value positions that are interacting to generate the future. They are:

A. U. S. middle class (traditional)
B. "New" values (proposed by humanistic-psychology writers and "forerunner" youth)
C. Behavioral science

D. American origin (implicit in founding documents and Western political tradition)

It is apparent that the "new" values (B) are challenging the traditional ones (A). One naturally looks to the behavioral scientists to see if they are uncovering any new knowledge of human behavior and characteristics that would shed light on the controversy. At a glance, it looks very much as though the behavioral sciences have an implicit value system of their own (C) that is not neutral with regard to the conflict. In view of this observation, it becomes of interest to compare all three of these with the set of values on which the nation is presumably based (D). This I propose to do briefly, after first summarizing the four sets.

U.S. Middle-Class Traditional Beliefs and Values

I mean by this title the beliefs and values that have dominated U.S. industrial society and that today's youth tend to reject, at least in part. It is difficult to be explicit, since the values of the middle class are changing and have clearly departed considerably from what they were in the 1930's, both in the direction of diversity and pluralism, and in an overall shift toward the "new" values described below. This brief summary describes, at any rate, a representative position.

Beliefs. Implicit in this belief-and-value system is the understanding that, while religious beliefs are good to have as a basis for morality, the values derived from the Judeo-Christian tradition will stand by themselves on a pragmatic basis. Hence, there tends to be little emphasis on specific religious beliefs or metaphysical premises as a source of values; atheists, agnostics, Christians, and Jews are expected to have more or less the same values. Thus, without being tied to a particular cosmology, there tends to be a generalized belief

- in the perfectibility of man and in his ability to better his position through his own efforts
- in material progress as the meaning of social progress
- in humanitarianism and a moral orientation to the world

Individual-rights values. A high value is attached to the rights to (1) individual pursuit of economic security and happiness, (2) personal liberty (freedom, privacy, and property rights), (3) equality of opportunity and justice, and (4) essential respect as a human being. These rights are strongly tempered by the ethic that one must earn what he gets, through industry and persistence.

Life-setting values. Value is placed on the orderly society, with social roles and rules for transition well defined, and domestic and civic virtues commonly held. Pleasantness of environment and the esteem of others are prized. Meaning in life centers largely around success and achievement in terms of money, property, power, and status. For these goals one is willing to sacrifice present pleasures and to postpone gratification until the future. Self-discipline, hard work, efficiency, and productivity are honored; the emotional life should be well regulated and rationalized.

Personal characteristics. The following personal characteristics are valued: industry, integrity, dependability, self-sufficiency, rugged individualism, control of inner feelings, moderation, rationality, orderliness, regularity, conformity, pragmatism, cleanliness, responsibility, loyalty to family and firm, patriotism, Apollonian style, action as contrasted with contemplation, youthfulness.

"New" Values

These are the beliefs and values of the humanistic and existential psychologists (Erich Fromm, Abraham Maslow, Carl Rogers, Rollo May, etc.) and the youth culture labeled "forerunner youth" by *Fortune* magazine in a recent survey (January 1969). This position is much more explicit than the previous one in what it affirms about man.

Beliefs. Basic premises include the affirmation that fundamental to all else in human experience is awareness. Through his awareness of himself and of his relations to others and to the universe, man can discover values that are wholesome in terms of promoting his growth toward the most fully human state in which he can actualize his highest potentialities. Man responds to a hierarchy of perceived needs, but ultimately his basic dynamic is toward growth and becoming.

Individual-rights values. The highest value is attached to the individual's right to pursue self-fulfillment, personal liberty, equality of opportunity and justice, and essential respect as a human being. These values are considered to be not just pragmatically desirable, but rather to follow directly from the affirmation of the essential validity of inner experience and from the collective subjective experience of the race.

Life-setting values. Meaning in life centers around the discovery and actualization of one's highest potentialities, the pursuit of self-fulfillment. The desirable environment is one that promotes growth and fosters inner freedom; i.e., it is truthfully responsive and ultimately supportive, as the therapist is to his client. Self-discovery experiences are to be sought, not avoided. Thus conflict and ambiguity are not threats to the

good life, but pathways to it. Beauty and deep personal relationships are highly valued, again because in experiencing them one more fully experiences himself.

Personal characteristics. The following personal characteristics are valued: openness, authenticity, integrity, sensitivity, aliveness, spontaneity, self-honesty, balance between or transcendence of opposites—reason/emotion, Apollonian/Dionysian, work/play, self/not-self (Maslow 1967).

Behavioral Science

There is, of course, no single viewpoint that faithfully represents the views of behavioral scientists as they apply their knowledge to matters of social policy and social values. However, one could perhaps think of some kind of center-of-gravity viewpoint. The attempt is important because the behavioral-science viewpoint is influential, and because it is espoused by so many of those who wrestle with social-policy questions. A reasonable approach would seem to be to examine writings of behavioral scientists relating to social problems, and the textbooks from which behavioral science is taught. The latter particularly are strongly influenced in their implicit premises by the behaviorist tradition in psychology and by Freudian psychoanalytic theory.

Beliefs. The basic premises include the assertion that human behavior can best be understood as an interaction between more or less stable characteristics of the individual and the immediate situational context. The individual characteristics—personality patterns, values, goals, etc.—arise in turn from the past interaction between physiological needs and instinctual energies and desires on the one hand, and environment—particularly that of early childhood—on the other. Socially acceptable behavior is arrived at through socialization (conditioning) processes.

The behavioral-science position tends to be reductionist, especially regarding such "higher values" as freedom, justice, love, cooperation, reason, courage, free will, truth, beauty and goodness, self-fulfillment, and responsibility, regarding them as sublimations of instinctual drives or as more straightforward cultural conditionings. Thus, the basic value position is one of moral relativism.

Individual-rights values. Such rights as the individual pursuit of happiness, personal liberty, and equality of opportunity are deemed good for a society to have on a rational, pragmatic basis. However, altruistic behavior is basically at variance with man's instinctual (aggressive, territorial, etc.) nature, and it has to be instilled by the culture.

Life-setting values. Likewise, such values as social order, justice, social consciousness, democracy, humanitarianism, public service, morality, achievement, etc., are perpetuated by the culture because of their usefulness; but they have no deeper transcendental roots. Because of the implicit assumption of determinism, such values as freedom and democracy, which imply that the individual ultimately has free will and is responsible for his actions, are not only cultural inventions, but illusions.

Personal characteristics. Various personal characteristics may be valued, particularly scientific objectivity, intelligence, and impassivity. However, it is recognized that the choice to value these characteristics is itself illusory in its freedom, since they must have been culturally imposed somewhere along the way.

American Origin

The speeches and writings of the nation's founders contain the basic premises and central values of the Western political tradition and the specifically American additions.

Beliefs. The most important basic premises underlying the nation's founding are that the universe has a physical and moral order, that Natural Law is discoverable by man, and that man intrinsically strives toward the understanding of the natural order and toward the perfection of his nature. "Unerring order and universal harmony reigning throughout the whole... God is the power of first cause, nature is the law, and matter is the subject acted upon" (Thomas Paine). Social order is to be derived from man's universal nature. The history of man is a progression in time toward a definite, supremely meaningful end in which human fulfillment is achieved. Man's purpose in history is to seek individual realization and social and political justice. Man has the free will to accept or reject natural purpose and natural law.

Individual-rights values. Supreme rights are those to life, liberty, and the pursuit of self-fulfillment; to equality before the law and equality of opportunity; and to freedom with regard to spiritual beliefs and the rituals and life patterns in which they are expressed.

Life-setting values. Among the specific life-setting values commanding high allegiance are:

- the mission of America to bring a new order into the world
- the prime function of society to serve the individual's rational and purposeful perspectives and acts
- a binding, just, and adaptive system of common and constitutional law

- the supremacy of the General Will (what people ought to want in the light of the ethic of the Western political tradition and of their own rational, individual, and social interests) over temporary popular desire
- the right and duty to resist when government does not fulfill its responsibilities to the individual and becomes tyrannical and destructive
- equal opportunity, special privilege for none
- education: "Enlighten the people generally, and oppression of mind and body will vanish like evil spirits at the dawn of day." (T. Jefferson)
- harmonious and successful human relations, spiritual salvation, reason, tolerance, freedom, justice, cooperation, persuasion rather than force, individual responsibility, enlightened self-interest

Personal characteristics. The following personal characteristics are highly valued: integrity, responsibility, rationality, industry, self-sufficiency, fairness, spirituality, patriotism, humanitarianism, idealism.

With these summaries of four belief-and-value systems before us, we have a useful way of looking at some contemporary issues. The traditional middle-class premises are congenial to the "second-phase" industrial kind of future. The "person-centered" society, on the other hand, would require a shift of dominant values in the direction of the "new" humanistic-psychology and forerunner-youth basic premises. Changes in basic premises are not easily brought about; there is little indication that deliberate attempts to change basic premises and value positions, through conventional educational processes, are very successful. On the other hand, the "new" values appear to have a strength in today's culture that would hardly have been anticipated even a half-decade ago.

Formal education positions have been strongly affected by the behavioral-science premises in recent decades. These premises are more in line with, and supportive of, the traditional middle-class values.

Interestingly enough, the "new" beliefs and values turn out to be remarkably similar to those forming the ideological basis for the founding of the nation; hence, the accusations by disaffected youth that the Establishment is false to its declared values.

Let us take a closer look at these accusations and the dynamics of their expression, since the nature and resolution of these revolutionary forces will clearly have much to do with the choice the society makes among its possible alternative futures.

5

Manifest Revolutionary Forces

THERE is little need to make the case that recent years have brought a rapid growth of political and social disorder. Conflict between whites and nonwhites, at a high level for years, has recently become more overt and violent. At the same time, alienation of youth and minority groups from the "military-industrial-education complex" and from national aims and policies has been expressed in an increasing level of violence. Educational institutions have found themselves furnishing a stage for much of the enactment of this drama. We have seen campus demonstrations escalate from sit-ins to forcible seizures, and then to armed seizures; likewise, the responses of enforcement agencies have moved from debate to mass arrests, tear gas, and bayonets. There seems no reason to assume that events in the months to come will not involve similar expressions of dissidence.

Indeed, we may confidently expect that educational institutions will continue, by virtue of their important position in a technologically advanced society, to be at the center of the fray. For this reason, it will be useful to consider a framework for viewing the significance of contempo-

rary revolutionary forces. This conceptualization will attempt to gather superficially unrelated events into an overall pattern. Its "fit" can be seen with sureness only in historical retrospect; it cannot be demonstrated. The heuristic test is how well it seems to accommodate further developments. Hopefully this framework will help us to see more clearly how present responses to revolutionary forces relate to alternative futures.

"Causes" of Dissent

The overall situation regarding civil unrest, dissidence, and violence is obviously complex. At the level of manifest phenomena it has many aspects—student rebellions, ghetto riots, minority-group threats, organized movements for violence and assassination, rising sentiment against the Vietnam war, deteriorating national image at home and abroad, attacks on the "military-industrial-education complex," concern over inadequate response to social problems, and demands for participatory democracy, to mention a few. At the more fundamental level of the social structure, present institutions and institutionalized roles, and present forms of power distribution, are being assailed. At a still deeper level, the operational values and goals of the power structure are being challenged. Under particular attack are the obsession with technocratic-economic values and the depersonalizing aspects of computerized bureaucracy. Some of these phenomena are worldwide. The underlying causes are clearly multifaceted.

To explain a variety of these phenomena and their appearance at this particular time, a number of causes have been proposed, including:

- disillusionment with liberal promises and programs, and with hypocrisy in the social structure
- the natural rebelliousness of youth
- permissive child-rearing patterns
- activities of foreign subversive agents and internal revolutionaries
- moral reaction against the Vietnam war
- rising expectations among have-not groups
- disillusionment with widespread competitiveness, inequity, and hypocrisy
- revolution for the thrill of it
- rebellion against impersonality and "students as commodities" attitudes in universities
- the continuing fight for civil rights
- the demand for student participation in educational decisions

- the draft
- the greater number of average years of formal education and, hence, the extended period of youth to have its own, separate culture
- underlying anxiety over the threat of nuclear annihilation
- neurotic reaction to a confusing world

Such partial explanations, however, do not appear to do justice to the facts. Various evidences suggest that instead of coincident but relatively unrelated phenomena, we are actually dealing with a complex of highly interrelated phenomena—so interrelated that they may be profitably viewed as one intricate underlying phenomenon, of which the specific events are but manifestations. Such an interpretation is suggested by the fact that the student revolutions are worldwide. Although specific issues in Paris, Mexico City, Tokyo, Morningside Heights, Berkeley, San Francisco, and Montreal differ widely, youth unrest appears to be almost a universal phenomenon. Many issues transcend the strictly educational ones. Students are strongly concerned with civil rights; student radicals may be seen in labor picket lines (some union members also participate in student demonstrations); and other targets of militant action include industrial corporations and nonprofit think-tanks.

A crisis is also often an opportunity. When a unified view is taken of contemporary revolutionary phenomena, constructive as well as destructive forces may be observed to be present. If so, this fact is most important to understand. As Noam Chomsky recently observed, "There now exist opportunities for change that are not very likely to recur" (1969). Perhaps the greatest danger in the present situation is that, in reacting to crush the threat to the social order represented by the revolutionary forces, we may unwittingly repress a constructive force for change in the direction of a fuller realization of the most basic goals of the nation and of the Western political tradition.

Two Components of Revolutionary Force

The two main issues implicit in contemporary revolutionary activity are (1) a demand for emancipation on the part of various subjugated or underprivileged groups, and (2) a demand for societal and moral reform on the part of persons, mainly privileged youth, who are not subjugated or impoverished in any ordinary sense.

These issues need to be viewed separately because, while satisfaction of the second demand tends to imply satisfaction of the first, the reverse is not true. Although the revolutionary fervor associated with the first

issue could probably be reduced by offering economic gains and limited power sharing, the force of the second might still remain.

The first issue is a demand, by groups who feel subjugated, for emancipation; for potency in the society; for an effective voice in decisions affecting their individual destinies; for the right to feel a sense of self-worth; or for equal social, economic, and educational opportunity in a system that does not deprive them of meaningful participation because they are black, or students, or poor, or "culturally deprived." Among such groups are

Blacks	Homosexuals, sexual deviates
Third World	Marijuana smokers
Students	Draft-age youth
Teachers	Psychedelic-drug advocates
Labor	Experimenters with marriage substitutes
Women	Opponents of the Vietnam war
Consumers	Welfare recipients and poverty groups
	Minorities in general

These various groups do not have identical aims, of course. Nevertheless, many of them find adequate common cause to be frequently seen in collaboration. (We do not mean to blur over the very real differences either —success has not crowned attempts to marry black, student, and labor groups. In addition, the groups vary considerably in the extent to which their claims for emancipation are recognized by, and trouble the conscience of, the dominant majority.)

The second issue is both a demand for person-centered values (and for institutional reform to that end) and a challenging of the values and the power of the "military-industrial-education complex."

In terms of values, this force represents a rejection of what we earlier described as traditional middle-class values, espousing instead what we called the "new" values. This group tends to define as immoral and bankrupt a national policy that is perceived as offering token reform at home and counterrevolutionary imperialism abroad. They point to a demonstrated inability of the present power structure to create a viable international order, to cope with environmental problems, to correct institutionalized and legitimated inequities, and to construct a technologically advanced society that does not at the same time affront and humiliate the human spirit.

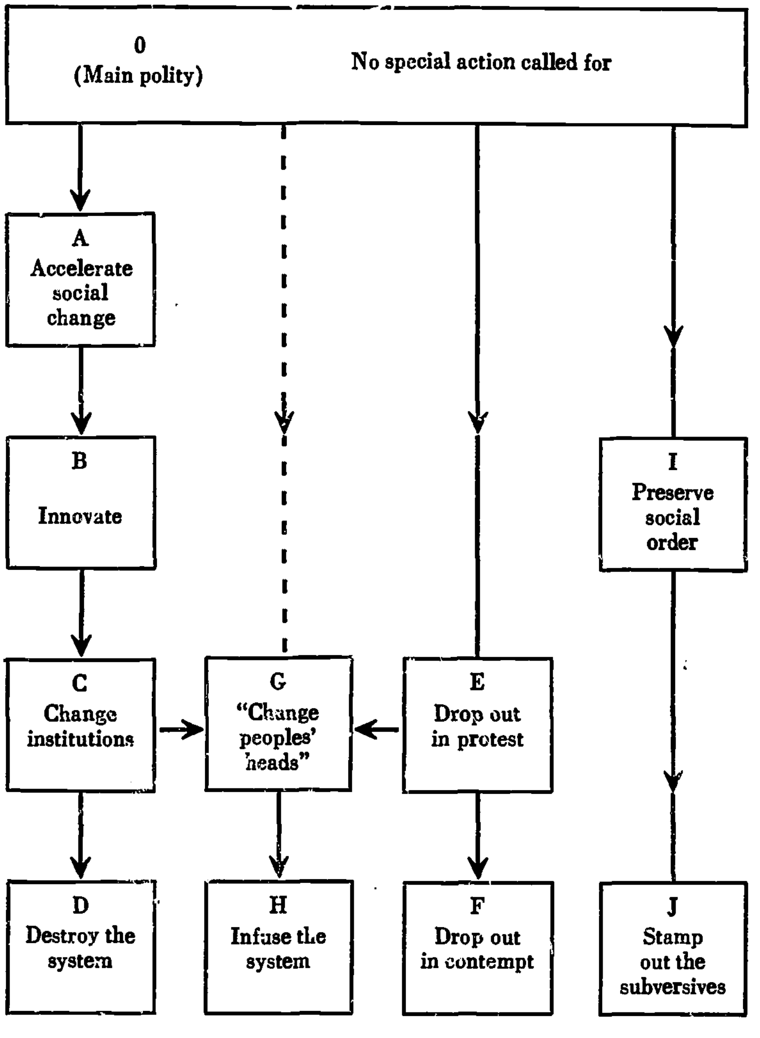
Analysis of Revolutionary Forces

In the remainder of this section I discuss contemporary revolutionary

forces and their significance, using as my context the diagram in figure 2. This diagram indicates various possible states of mind with regard to an individual's felt need for action, and notes transitions that seem to have

FIGURE 2

STATES OF MIND REGARDING AN INDIVIDUAL'S FELT NEED FOR ACTION ON ISSUES INVOLVED IN CONTEMPORARY REVOLUTIONARY FORCES



taken place as reflected in past events. The current situation of widespread civil dissidence thus will be viewed as involving numerous actors who hold various attitudes regarding desirable action to improve the lot of subjugated or underprivileged groups in the society or to effect societal and moral reform.

A major assumption of the diagram is that, as a result of a person's experiences, he may shift from one such attitude or state to another. Alternative policies may affect the probabilities of such shifts in different ways, and thus may contribute to the bringing about of alternative futures. With the aid of this framework, then, I will attempt to say something about the alternative future courses that events might take. I can only hope that the inevitable shortcomings of such a deliberately oversimplified model will be outweighed by its conceptual usefulness.

No special action called for. The box at the top of the diagram represents the main body of the population, out of which the primary actors in the revolutionary drama are drawn. It comprises a wide range of positions along the dimension inert-unconcerned to active-concerned, and also along the dimension liberal to conservative. The basic premises are that no unusual actions are called for, progressive social change is taking place at a safe and appropriate rate, and normal political institutions and processes are adequate for the accomplishment of desirable change.

Accelerate social change. Box A represents the state of having recognized serious inequities and inhumanities in the society and of having concluded that acceleration of social change is required. Implicit is the assumption that declared intentions are genuine and that legitimated political actions are adequate to the needs.

In the case of civil rights, persons sharing these premises participated in the Montgomery bus boycott (1955), the forced integration of schools (1956 on), the Southern lunch-counter sit-ins (1961), and the passage of the Civil Rights Act (1965). Persons of this attitude state were also involved in the civil rights march on Washington (1963), the passage of the Economic Opportunity Act and the beginning of Community Action Programs (1964), the passage of the Elementary and Secondary Education Act (1965), and other portions of the war on poverty. Clearly the actors in these cases included both members of the economically and socially underprivileged minorities and persons for whom the demand for societal and moral reform was a more idealistic one.

Student reactions to the Vietnam war, the draft, "nonrelevance" of higher education, etc., began mildly in the early sixties (remember the apathetic fifties?), gained momentum rapidly in 1964, and in a sense culminated in the youth-for-McCarthy campaign of 1968.

Innovate. State B in the diagram represents the position that simply speeding up processes underway is not adequate to the need; instead, innovation is required. Many students and minority leaders came to this position as a consequence of disillusionment over the failures of type A responses. These persons lost faith in the adequacy of normal political processes and arrived at the conviction that new types of political action would be necessary to awaken moral sensibilities and to generate response to the problems.

Among the significant "tests" of the system waged by persons embracing this attitude were the HUAC demonstration in San Francisco (1961), the Mississippi summer project and MFDP at the Democratic Convention (1964), and the stop-the-draft demonstrations of 1967, particularly at the Oakland Induction Center and the Pentagon. Innovative political actions included the formation of the Students for a Democratic Society (with its initial emphasis on working with Congress) in 1962 and the Free Speech Movement in 1964; the initiation of experimental colleges and free universities in 1966; the launching of National Student Association-sponsored tutorials for minority-group students in 1963; and the first forms of Black Power in 1966.

Change institutions. State B turned out for many to be a transition state, leading to the conviction that present forms of institutionalized power are intrinsically inadequate to deal with the massive social problems of the day. The solution to social ills was therefore seen by these persons as coming through radical change of institutional forms. Since awareness of this inadequacy is obscured by the ability of the Establishment to enculturate and to co-opt, it follows that confrontations and other radicalizing activities are necessary to bring about this awareness.

A subsidiary premise is that groups in power seldom share that power willingly. Hence, a group perceiving itself to be without legitimated power must fall back on coercion and at least the threat of violence to effect social change.

Events involving persons of this persuasion included (1) the emergence (around 1967) of such major confrontation-instigating agencies as SDS, Black Student Unions, and the Black Panther Party; (2) major confrontations between students and police on campuses (1967-69), and student strikes (1968); (3) "street people" and police clashes over the "peoples' park" issue in Berkeley (1969); and (4) urban ghetto riots (1965-68). Again, both the economically underprivileged and the disaffected privileged were involved, but with goals that differed significantly. (In terms of Maslow's need-concern levels, both deficiency-moti-

vated and growth-motivated persons were involved, but their inner dynamics were different and at certain stages or on some issues they may have parted company.)

The groups holding this radical premise vary widely in their willingness to escalate the level of violence. This willingness depends, in part, on the nature and severity of suppressive forces applied. The overall radical strategy has been made clear in the statements of radical leaders, and is simple enough in its logic. It is to continue to apply force, moving toward methods that are more and more economical of resources (in terms of losing fewer men to the jails, hospitals, and morgues) and more and more difficult to suppress. Thus, the canonical sequence moves from mass demonstrations, strikes, and riots, through sabotage, terrorizing, and urban guerrilla warfare, to the weapon of last resort—selective assassination. The extremist end of this sequence corresponds to state D, the real political revolutionary. However, many of the militants seem to be moving from this premise to state G, the "psychological revolutionary." And we see some signs that severe repressive measures combined with little evidence of solid social change can lead many of this group to retreat into apathetic resentment, discouragement, and smoldering hate for the whole system.

Destroy the system. The basic premise represented here is that the whole system is evil and has to be torn down. Whereas some persons of persuasions C and G feel that the threat of "destroying the system" is necessary therapy to jolt people into awareness, this group means it. This point of view is represented by the positions of the Progressive Labor Party, by various Marxist, Castroist, and Maoist groups, and by extremist anarchist nongroups. It is patently true that the overall revolutionary movement is not solely Communist inspired in its origins; to exaggerate the contribution of subversive exogenous agents is as serious an error as to assume that they are not present at all. However, it is equally true that elements of the movement are closely allied with the international radical left.

Drop out in protest. Another revolutionary attitude represented in the diagram stems from the basic premise of the possibility of expanded consciousness. It became nationally significant in 1963 with the founding by Harvard's Timothy Leary of the International Foundation for Internal Freedom (IFIF), promulgating the ethic "Turn On, Tune In, Drop Out." This psychochemical beginning led to the hippie phenomenon; widespread interest in Eastern philosophical religions and meditative practices; psychedelic light shows, rock music and lyrics (with rock radio stations as a worldwide communication network carrying the revo-

lutionary message); black-market drugs and the psychedelic movement in the name of "religious freedom"; and hippie dropouts, love and flower power, sexual freedom, and the establishment of communes.

Drop out in contempt. Some members of Group E, with their newfound "expanded awareness," took a good look at what man was doing to man in the social system, and moved from a position of "drop out in protest" to one of "drop out in contempt." With this viewpoint are often associated libertinism and unrepressed sensuality, flaunted hedonism, and general rejection of work, discipline, and conventional social amenities. Although the members of this group have removed themselves from the field of action, they are of concern both because of the loss of human resources they represent and because they tend to become associated with drug abuse and related crime.

"Change peoples' heads." Not all of the "turned-on" generation, however, view the dropout as the desired permanent state. Rather, for some of the dropouts it became more like the "withdrawal and return" of Toynbee and Jung. These persons tended to "reenter" society with a new political awareness, joining forces (state G) with some of the political activists who were "turning on" to the conviction that "the real revolution is not in the ghetto or on the campus, but in peoples' heads." In this view it is inner change and not institutional reform alone that will help solve society's ills.

Here these persons find common cause with another group whose members sometimes refer to themselves as the "human potential movement" (represented by the dotted line in the diagram). If one wanted to pick a date for the beginnings of this movement, the initiation of the Esalen Institute programs in 1961 would be as suitable as any. From these beginnings at Big Sur the movement has grown to include well over a hundred "growth centers" and free-university programs, and to involve thousands of psychotherapists, sensitivity training and psychodrama group leaders, sensory-awareness teachers, yoga teachers, and assorted gurus.

As we have seen, the basic premise associated with this state is that necessary social change will come about only through widespread person-changing. To this end, its proponents have developed and use a "person-changing technology" as indicated in table 1. Emphasis is on a dual awareness of (1) the higher-consciousness nature of man and the bankruptcy of the scientific-technocratic and behaviorist views of man, and (2) the institutionalized inequity and inhumanity in the social system. The techniques near the top of the list in table 1 tend to aim more at

TABLE 1

Elements of "person-changing technology"	*Typical outcomes*
Meditation Yoga Psychedelic drugs Hypnosis, autohypnosis Psychosynthesis	Awareness of spiritual dimensions, of transcendental self, of the "hypnotic" or "encapsulated" nature of ordinary life
Sensory awareness	Sensitivity to feelings and emotions, beauty
Self-awareness exercises Psychotherapies Group therapy	Sensitivity to human closeness, self-honesty, realization there is nothing to hide
Sensitivity training Encounter groups Gestalt therapy Group nudity, marathons	Spontaneous response to experience, self-expression, individual autonomy, emotional freedom
Psychodrama	Removal of guilt and fear stemming from early training regarding morality and sin
Synanon games New Theater (ridicule of Establishment, crudity and nudity, audience encounter) Forceful disruption of normal social process Underground press Radicalizing confrontations	Ego-reducing experience, awareness of ego-defense nature of social institutions and customs
Deliberate provocation or "instructive encounters" such as police confrontations, black-white confrontations, etc.	Perception of oppressive nature of social institutions

expanded self-awareness, and those near the bottom at heightened social awareness.

Infuse the system. The number of persons in this state is small but apparently growing. Its basic premises are similar to G, with the additional premise that the best way to get radical change is to carry on a "subtle revolution"; that is, while dressing and acting conventionally, infuse the system and be "in the world but not of it."

Preserve social order. The rapid rise of revolutionary thought and action in the last decade, particularly among the nonwhites and the youth,

has caused a considerable fraction of the polity to conclude that special action is called for to preserve the social order. In particular, the existence of states D and F is seen as constituting a serious social problem, requiring some sort of counterresponse from the system.

Stamp out the subversives. Some who may once have held opinions similar to state I have moved on to the premise that all these revolutionary views from B through H are subversive and anti-American and must be stamped out. The right-extremist groups are exemplars of this position.

Alternative Outcomes

This extended analysis of revolutionary forces—which at first glance may seem to be but one of many indicators of future trends—has seemed justified because it is here that the forces shaping the future are focused. The issue in the revolutionary activity *is* the future. If the insurrectionist forces are seen by the populace and its elected representatives essentially as lawbreakers attempting to gain by coercion that which should properly be obtained by legitimate processes, the tendency will be simply to suppress them. If, in addition, a large number of dissidents persist in making demands for reform that they consider legitimate, then this could lead us a long way toward a garrison-state kind of future in which a partially armed militant minority (consisting possibly of elements of militant blacks, other nonwhite groups, far-left labor, and idealist youth) is held in check by the overwhelming power of the military state.

NEW POWER BALANCE

Another possible sequence of future events would be a period of disruptive violence followed by a restructuring of social institutions to accommodate a new power balance. Such a course of events would roughly parallel that of the labor movement of 50 years ago. We can envision this course of events unfolding as follows: The Establishment (management and owners in the earlier case) perceives the demand for sharing of power as illegitimate and threatening. They make attempts at token sharing that delay confrontation, but in the end fail to satisfy the developing radical consciousness. The "outs" increasingly resort to force and violence, and the "ins" continue to counter with limited force.

It becomes apparent that the rising tide of expectations and demands is not going to go away. Furthermore, the "outs" have the power to disrupt and incapacitate industries, social institutions, and social processes in general to any degree they deem necessary as long as their numbers remain significantly large—and the repressive force limited. Thus, with

the only other alternative being massive repression, which is unacceptable to the populace, the Establishment is forced to accept the dissidents' demands for shared power. Social inventions (unions, collective bargaining techniques, etc.) are worked out to implement the new power balance. A consensus emerges that the new shared-power arrangement is workable and even seems more in line with our declared national and cultural values than was the previous arrangement.

One version of this latter "future history" might be characterized by the "buying off" of students by granting them some measure of power, and of minority groups by providing a measure of equality and security, thus thwarting or postponing the threatened revolution. That is to say, the major changes demanded by the revolutionary forces might be forgotten if enough secondary prizes were offered. This might leave the social, political, and economic structure of the nation relatively unchanged—at least temporarily.

REALIZATION OF FOUNDERS' GOALS

On the other hand, a point of view more or less represented by state G in figure 2 might ascend to dominance. In brief, this is the position that the present revolutionary agitation is in direct line of descent from the American Revolution, whose central aims were to secure for the individual (1) representation in the making of decisions that affect his destiny, and (2) freedom to pursue self-fulfillment in ways that do not deprive others of the same right. In the same line of succession is the social-reform component of the labor movement.

In this view, the contemporary revolutionary forces tend to be seen as essentially an accompaniment to a drastic evolutionary jump that society, and perhaps man himself, is attempting to make. If indeed this interpretation comes to dominate, then national policy-makers will tend to use the opportunity provided by the militant pressure to accelerate progress toward the basic goals implicit in the founding of the nation, while continuing the necessary suppression of violence and of infringement of others' rights. A development that makes this course of history fairly likely is discussed in the next section.

TWO COMPONENTS OF UNREST

The preceding discussion is based on a number of analyses of current social unrest, all of which are listed in the bibliography. In the months ahead, many additional studies undoubtedly will be published that may fit into the framework presented here, or that may furnish new or alternative insights. To whatever extent the framework in figure 2 stands up in

the light of further data, it may furnish a useful basis for comparing the alternative policies. It is evident, for example, that an incomplete understanding of these complex phenomena may lead to policies that drive individuals into states D and F (and hence build up the population in state J). Other policies based on a more complete understanding might encourage movement toward states G and H.

However, the most important proposition emerging from these analyses is that the unrest appears to comprise a combination of two quite dissimilar phenomena. One is a current version of the class warfare, significantly aligned along color lines, that has characterized human civilization throughout history. The other phenomenon is uniquely a product of our advanced technology and industrialization. This is the revolt of middle-class youth against middle-class values and the technological society. Clearly it would be a great error to attribute this second component of the disquiet to an international leftist conspiracy, or to interpret it simply as pampered youth challenging the authority of their elders. Rather, it is a much more fundamental malady of the entire society.

Youth feel a sense of powerlessness arising out of the realization that we have somehow lost control over our gigantic, Frankensteinian, technological-industrial machine. They know that they can count on a fair measure of material comfort and security, but they find little of value in their promised place in the bureaucratic-technological society, where their talents will be exploited for the ends of the "Big Machine." They sense that the society is on a collision course with real trouble, and that nothing short of a drastic shift in its implicit values and organizational structure will avert disaster.

These two components, the perennial class warfare and the singular "great dissent," each have their own separate dynamics. Bad policy choices can result from taking only the first to be real, and explaining away the second as an idiosyncrasy of the younger generation.

The analysis of current social unrest is vital to consideration of education's future role. Not only does its fuller understanding give some clues as to the kind of future we may have to design education for. It also faces us squarely with the question of the kind of future education is to help bring about.

In the next chapter I shall examine a current that runs deeper still, and that may be in an even more fundamental sense an important part of the new youth dynamic.

6

A Possible Underlying Conceptual Revolution

POLITICAL revolutionaries and struggles of subjugated groups to redress the power balance are not new in history. (The "psychological revolutionaries" we examined in the last section are less familiar.) Likewise, cultural history records many instances of changes in values over time. However, here and there in the literature on the future—e.g., in Platt (1966), Boulding (1964), Teilhard de Chardin (1964), Mumford (1956), Matson (1964), and Becker (1969)—we find suggestions that something much less frequent in the history of man may be taking place, a major conceptual revolution.

Indeed, this phenomenon is so rare that one could argue that only once in the history of the Western world since Christianity rose to provide the first unified Western thought has there been a drastic shift in dominant basic premises—namely, that associated with the Protestant Reformation. Max Weber and his followers in sociology have contended that when a significant change occurs in a society it is the whole sociocultural system that changes, including institutionalized organizational forms, roles, norms, traditions, values, and basic belief premises. Thus, related

to the shift in beliefs and values from the theological view of the Middle Ages to the Protestant ethic and economic view of the modern Western world were, it is claimed, such social changes as the rise of modern corporate capitalism, the Industrial Revolution, and the subsequent explosive growth of technology.

There do seem to be at least superficial parallels between events of the past decade and those of the sixteenth century. That period, too, was one of multiple revolutions:

- the Protestant revolt with its Anabaptist groups reminiscent of modern student protest groups
- the challenge of a new economics in the rising of capitalism
- the beginnings, with Copernicus, of the scientific revolution
- a revolutionary "age of exploration and discovery"
- the commercial and price revolution—rearrangement of social classes, redistribution of wealth, and urban growth
- redistribution of authority—political centralization and nationalism, substituting secular for religious authority
- technological revolution (the printing press)

If, indeed, the contemporary manifold evidences of revolutionary ferment are related to a shifting in dominant belief-and-value assumptions within the culture, such a shift may well bring as pervasive and varied changes in the society as accompanied the rise of the Protestant ethic.

Evidences of a Shift in Basic Assumptions

The evidence we shall examine briefly indicates, first of all, an increased tolerance in the popular culture for belief systems that tend toward metaphysics or transcendentalism in contrast with the agnosticism and skeptical materialism of the post-World War I period. Second, it indicates an opening up of the basic presuppositions within science to allow conceptual models not limited by the positivistic premise.

Aldous Huxley was one of the first modern writers to suggest that an age-old set of basic assumptions about the nature of man was showing new strength. I shall borrow his term, "The Perennial Philosophy":

> *Philosophia Perennis*—the phrase was coined by Leibniz; but the thing—the metaphysic that recognizes a divine Reality substantial to the world of things and lives and minds; the psychology that finds in the soul something similar to, or even identical with, divine Reality; the ethic that places man's final end in the knowledge of the imminent and transcendent Ground of all being—the thing is immemorial and universal. Rudiments of the Perennial Philosophy may be found among

> the traditionary lore of primitive peoples in every region of the world, and in its fully developed forms it has a place in every one of the higher religions. A version of this Highest Common Factor in all preceding and subsequent theologies was first committed to writing more than twenty-five centuries ago, and since that time the inexhaustible theme has been treated again and again, from the standpoint of every religious tradition and in all the principal languages of Asia and Europe. (1945)

The basic proposition of the Perennial Philosophy is an experimental one, that man can under certain conditions attain to a higher awareness, a "cosmic consciousness," in which state he has immediate knowledge of a reality underlying the phenomenal world. In speaking of this reality it seems appropriate to use such words as infinite and eternal, Divine Ground, Brahma, Godhead, or Clear Light of the Void. From this vantage point, one's own growth and creativity, and his participation in the evolutionary process, are seen to be under the ultimate direction of a higher center (Atman, the Self of Vedantic writings, the Oversoul). Ordinary perceptions of one's life and of one's environment are likened to the perceptions of a hypnotic trance. Such phenomena as extrasensory perception, precognition of future events, levitation and other psychokinetic events, "instant" diagnosis and healing, etc., are only extraordinary, not a priori impossible.

The basic assumptions of positivistic science stand in relation to the Perennial Philosophy much as Newtonian mechanics relate to relativistic physics: They are in no way invalidated for those aspects of human experience to which they are appropriate, but comprise a special case, a limited form of the more general theory. Similarly, the philosophies of materialism and idealism are to each other as the wave and particle theories of light and matter; each fits the world as seen with a particular mode of observation, and a complementary relationship holds between them.

Of course the Perennial Philosophy is not new to Western culture. It is present in the Rosicrucian and Freemasonry traditions. Its symbolism in the Great Seal of the United States, on the back of the one dollar bill, is testimony to the role it played in the formation of this country. It also appears in the Transcendentalism of Emerson, the Creative Evolution of Bergson, and the extensive writings of William James.

Whether one attributes its recent popularity to increased intellectual openness and tolerance or to anxiety brought on by the nuclear threat, indications abound that increasing numbers of persons seem to be taking its premises seriously. Rising book sales in religion, metaphysics, tran-

scendental philosophy, Eastern religious philosophies, and parapsychology indicate growing interest in these related areas. Contemporary song lyrics—e.g., the rock music of Dylan, Donovan, and the Beatles; the recent "Age of Aquarius"; and the melodic "On a Clear Day" ("rise and look around you, and you will see who you are")—contain numerous subtle and not-so-subtle references to Perennial Philosophy viewpoints. Metaphysically oriented churches, societies, and study groups are much in evidence. Courses and lectures on Eastern religious philosophies are well attended in free universities, 100 or more Esalen-type growth centers, university extension courses, adult education courses, etc.

Part of society's thus far negative reaction to monistic and Eastern kinds of beliefs, as they have appeared in the hippie culture, the drug scene, and numerous cults, has been due to the fear that they would lead to quietism and withdrawal, thereby undermining the social structure. Although it is true that these beliefs have been associated with quietism in the Eastern world, there is in fact nothing in the Perennial Philosophy premises that is contrary to virile and active participation in economic and political affairs. Neither are these premises in any way contrary to a high-technology society; they only say something about the ends to which that technology should be put. The kind of society that Erich Fromm talks about in *The Revolution of Hope*, or John Galbraith in *The New Industrial State*, or Michael Harrington in *The Accidental Century*, is completely compatible with the Perennial Philosophy premises. Such a society, with its high level of technology, would tend to be education and growth centered. Education in the society, like the Greek ideal as described in Werner Jaeger's *Paidea*, would place high emphasis on "the search for the Divine Center."

Beginnings of a New Science

Even more important than indications of a shift in the attitudes of the public at large, which by itself might appear to be a mere fad, are indications that scientists who hold membership in recognized scientific associations are showing more and more interest in developing a science of ordinary and extraordinary subjective experience. The study of "altered states of consciousness" is not completely new, of course. The phenomena of hypnosis have been studied in a scientific way, off and on, for at least a century and a half. Phenomenology has been a sporadic influence in psychology. Freud's psychoanalysis and its offshoots have attempted to probe the unconscious processes.

Many of the pioneering works in this area have assumed premises

akin to the Perennial Philosophy, e.g., F. W. H. Myers' *Human Personality and Its Survival of Bodily Death*, Richard Bucke's *Cosmic Consciousness*, Pitirim Sorokin's *The Ways and Power of Love*, not to mention the writings of numerous Vedanta, Sufi, and Zen scholars. Among modern psychotherapists whose works fit into this same basic philosophical framework are C. G. Jung, Roberto Assagioli, and Hubert Benoit.

New scientific journals implicitly friendly to the Perennial Philosophy premises include the *Journal of Transpersonal Psychology* and the *Journal for the Study of Consciousness*. At the popular level, we have the new and glossy *Psychic*, a magazine "devoted to every aspect of psychic phenomena and related topics."

Research activity is significant in at least three current approaches to altered states of consciousness: feedback of EEG signals, psychedelic chemicals, and classical (by which I mean sensory deprivation, yoga, autohypnosis, hypnosis, meditation, etc.).

Two recent and significant advances have been made in this area. One is the increased access to and control of diverse states of consciousness, making them more available for exploration. The other is the appearance of physiological correlates to altered states (EEG, EMG, GSR, REM, etc.). This latter is of extreme importance in a philosophy-of-science sense. The scientist of subjective experience is now much more in the position of the physicist studying an electron, or the astronomer studying a galaxy, in that he can say, "Here is a phenomenon (dream, satori state, etc.) that defies strict definition, but that I can study through various correlates (alpha waves, rapid-eye-movement, verbal report, observable behavior, etc.)." In effect, it means that the barrier between objective, "public" data and subjective, "private" data is gone for good, and the legitimated boundaries for scientific scrutiny are thus extended.

CHARACTERISTICS OF THE NEW SCIENCE

The science of man's subjective experience is in its infancy. Even so, some of its foreshadowings are evident. With the classification of these questions into the realm of empirical inquiry, we can anticipate an acceleration of research in this area. Consequently, there is new hope of consensus on issues—especially value issues—that have been at the root of conflict for centuries (just as earlier there came about consensus on the place of the Earth in the universe, and on the origin of man). The new science bids fair to incorporate the most penetrating insights of psychology, the humanities, and religion. These developments will have profound impacts on the goal priorities of society, on our concepts of

education, on the further development and use of technology, and perhaps (as in the case of the Copernican revolution) on the distribution of power among social institutions and interest groups.

Young and incomplete as the science of subjective experience is, it is nevertheless already providing extremely significant foresight into how the man of the future will view his potentialities. Space does not permit documenting all the findings of this new science here;* however, the following three propositions have accumulated an impressive amount of substantiating evidence:

- The potentialities of the individual human being are far greater in extent and diversity than we ordinarily imagine them to be, and far greater than currently in-vogue models of man would lead us to think possible.
- A far greater portion of significant human experience than we ordinarily feel or assume to be so is comprised of unconscious processes. Included in these processes are not only the sort of repressed memories and messages familiar to us through psychotherapy, but also "the wisdom of the body" and those mysterious realms of experience we refer to with such words as "intuition" and "creativity." Access to these unconscious processes is apparently facilitated by a wide variety of factors, including attention to feelings and emotions, inner attention, "free association," hypnosis, sensory deprivation, hallucinogenic and psychedelic drugs, and others.
- Also included in these partly or largely unconscious processes are self-expectations, internalized expectations of others, images of the self and of its limitations, and images of the future—all of which play a predominant role in limiting or enhancing actualization of one's capacities. That is, such images and expectations tend to be self-fulfilling. (Much recent research has focused on the role of self-expectations and expectations of others in affecting performance. Research findings are buttressing the intuitive wisdom that one of the most important characteristics of any society is its vision of itself and of its future, what Boulding calls "organizing images." The validity of the self-fulfilling prophecy and of the self-realizing image appears to grow steadily in confirmation.)

* See W. W. Harman, "Belief Systems, Scientific Findings, and Educational Policy," EPRC Research Note No. 6747-4, Stanford Research Institute, November 1967.

Assuming that the evidence for these propositions continues to mount, they will have the most profound implications for the future.

RELATION TO REVOLUTIONARY FORCES

The real significance of a science of subjective experience and "altered states of consciousness" is that it is in this area that our individual and social values are experientially and historically rooted. The development of such a science would redress what in retrospect is a puzzling discrepancy between the audacity with which man has pursued the physical, biological, and social sciences, and the timidity with which he has confronted the development of a moral science. Already in the field of clinical psychology several scientists are proposing to formulate through their research "a natural value system, a court of ultimate appeal for the determination of good and bad, of right and wrong" (A. H. Maslow), with "universal human value directions emerging from the experiencing of the human organism" (Carl Rogers). What may be in the offing is a new means of obtaining consensus on value questions, by submitting them to the test of what is ultimately wholesome for the whole man.

As previously noted, the concern of young people with "awareness-expanding" and "consciousness-exploring" activities is intimately related to their own reformulated value convictions. Young people involved in these new activities have tended to espouse the Perennial Philosophy, with its strong affirmation that individuals do make a difference, and that values do have an eternal base. These convictions in turn reinforce demands for a person-centered rather than an Establishment-centered education, and for a society adapted to transcendental (or at least humane) man rather than to economic man.

If materialism was the philosophical base for the Old Left, it appears that transcendentalism may come to serve the New Left in a similar role. The revolutionary press intersperses among its political discussions and diatribes against various aspects of the social system, articles on Eastern philosophies, hip-drug use, the human-potential movement, transcendental meditation, and Krishna consciousness. On the other hand, *COSMOS*, the monthly newspaper of "the occult, psychic phenomena, spiritualism, ESP, metaphysics, New Age philosophies, and allied subjects," publishes articles on the youth revolution, the crisis in values, the generation gap, and social injustice. Rock stations, in a far-flung network, broadcast revolutionary messages in the lyrics of their songs and in their parodies of news programs; carry interviews and lectures relating to religious, metaphysical, psychic, and esoteric topics; and as a public service announce the meetings and fund-raising campaigns of religious study groups and

of organizations concerned with Subud, Scientology, Vedanta, and similar subjects.

In his penetrating analysis of the youth revolt, Roszak (1969) describes the new religious outlook of the young as "a phantasmagorial of exotic religiosity. . . . If one scans any of the underground weeklies, one is apt to find their pages swarming with Christ and the prophets, Zen, Sufism, Hinduism, primitive shamanism, theosophy, the Left-Handed Tantra. . . . At the level of our youth, we begin to resemble nothing so much as the cultic hothouse of the Hellenistic period, where every manner of mystery and fakery, ritual and rite, intermingled with marvelous indiscrimination."

Notwithstanding the complexity of this new outlook, Roszak notes, there is a unifying theme: "The world view of Lao-Tzu, of the Buddha, of the Zen masters . . . has become one of the strongest strains of the counter-culture. . . . The counter-culture *is*, essentially, an exploration of the politics of consciousness" (pp. 83, 140, 156).

It is obviously too early to tell whether the shift in operative values and basic premises, as I have described it, is taking place in a lasting way. If it does, we may expect to see as radical changes in the sociocultural system as when the belief system of the Middle Ages gave way to the Protestant ethic and capitalistic economics. If such a shift takes place, it would tend to support the "person-centered" society and the "new" and "American origin" values summarized in chapter 4.

7

Meta-Issues Of the Future

THUS far we have looked at manifest trends and countertrends and have examined several aspects of the alternative futures among which we, as a society, are in the process of choosing. I have argued, in a fundamental sense, that choosing the future involves choosing a set of beliefs and values to be dominant. Because the current issues in the dissidence of youth and minority groups may be assumed to be indicators of the choices with which the society is faced, I examined these in some detail. Various bits of evidence pointed to the possibility of a conceptual revolution in process, and I looked at those.

I am now ready to summarize what out of all this is directly relevant to educational policy. Let me, first of all, introduce a useful concept for my discussion, "choice point." By choice point is meant a point or period in time when the society as a whole makes a commitment of psychic, human, and economic resources in a particular direction. The associated decisions are multifold and are diffused in level (political, institutional, and value-belief), in time, and in space (some in Washington, some in other capitals, some in Wall Street, etc.). Some are made with awareness;

others may be made by default, or with relative unawareness of making any decision at all. The choice is not necessarily the result of a major decision by any one identifiable agency, but rather derives from an aggregate of decisions made more or less simultaneously (in the long-term historical sense) by different elements of society. An example would be the choice to provide some sort of old-age security, which took the form of numerous state and federal laws and amendments, and a host of less identifiable decisions by unions, committees, employers, etc.

In the preceding pages I have argued that the United States is presently at such a choice point, in moving toward either what I termed the "second-phase" industrial society or the "person-centered" society. It is obvious that no one in the White House or anywhere else will actually make such a decision. But in effect, through a multiplicity of decisions made by such groups as the Congress, the Pentagon, local school boards, and industrial management, the choice is being made. At one level a decision may have to do with pollution of a local river, at another with the structure of regional government, at another with the values taught in the schoolroom. The form of education in the future will be much affected by which way society chooses to go. On the other hand, educators themselves have the opportunity to affect this choice, at least in part. For, just as the beliefs and values of a society determine the kind of educational system it chooses to have, so does the educational system affect what beliefs and values are either perpetuated or changed.

An important component of this choice rests in the decision of how to handle the current forces of political dissent and insurrection that consist particularly of our youth and minority groups, since the issues posed by these groups are in considerable measure the same as those involved in the larger choice. The possibility of a conceptual revolution, which I examined earlier, is also involved in this choice, and as I have also shown, is intimately connected with the youth revolt. In addition, I showed that the premises of the Perennial Philosophy are compatible with the "person-centered" society, although not demanded by it.

Now let us look at the changes in society one more way before I summarize how all of this relates to education. From all of the trends and alternative futures and revolutionary issues there emerge some meta-issues, or "issues behind the issues." I shall single out four. These meta-issues may seem to be at the level of questions about the nature of the good life and the good society. And indeed they are. But they are also implicit in such questions as what shall we do about local control of schools, drug use in high schools, student rebellion over school rules, sensitivity training, Black Studies programs, the role of vocational edu-

cation, the quality of ghetto schools, new career ladders for minority-group teacher candidates, and person-centered curricula. Indeed, the choice the society as a whole makes on these meta-issues will determine in considerable measure what courses the schools will be able to take on the more specific issues.

Thus, far from being theoretical and impractical, these meta-issues are the important ones to keep an eye on. I select four as being among the most crucial. I label them as four "crises," using the word in its root meaning as a turning point, and recognizing that they may not merit the connotation of emergency that is often associated with that word. These issues are the keys to the "unsolvable macroproblems" mentioned earlier. They are a crisis in human image, a crisis in authority, a crisis in economic values, and a crisis in pluralism.

THE CRISIS IN HUMAN IMAGE

I have already noted, in discussing the possible conceptual revolution, that a conflict exists between the basic premises of democracy—that man is, by virtue of his transcendental nature, endowed with reason, will, and a valid sense of value—and the reductionistic, deterministic, and physicalistic premises of the behavioral-science, sociopolitical theory that our universities impart to their annual crop of budding sociologists and political scientists.

The young social scientist is taught a sociology that has shifted away from its earlier emphasis on the semiphilosophical "humanities" approach to an emphasis on techniques and empirical studies. Man is implied in these latter studies to be a creature of his drives, habits, and social roles, and in whose behavior reason and choice play no decisive part.

In psychology this point of view is likely to be made even more explicit to the student, with consciousness considered an inconsequential accompaniment to behavior governed by external stimuli and instinctive urges. His political science tends to focus on the processes by which public policies are made, and to be relatively unconcerned with their contents. Amid the modeling of society and governments and the measurement of attitudes, population movements, organizational trends, and political behavior, little attention is given to the historically significant questions relating to man, his condition, and his destiny.

On the other hand, the concept of a transcendental, choosing, ultimately responsible self is essential to the entire theory of democratic government. It underlies the assumption that the criminal is responsible for his act (while recognizing through the provision of rehabilitation opportu-

nities that his antisocial traits may have their roots in environmental conditioning). It is basic to the assumption in the judicial process that the judge can meaningfully make a normative judgment. Matson (1964) has cogently analyzed the consequences of overemphasizing the objective perspective in political affairs (as contrasted with a complementary relationship between objective and humane perspectives).

Drucker (1939) was one of the first to sound the demise of the image of Economic Man: "The belief in the desirability and in the necessity of the sovereignty and autonomy of the economic sphere is disappearing; and with the belief, the reality. . . . It is the characteristic feature of our times that no new concept lies ready under the surface to take the place of Economic Man." Such a new image may be emerging now.

Mendel (1969) speaks of the rejection of the image of Economic Man by youth as "the Great Refusal against that pitiful caricature of man created by five centuries of urban, technological, and scientific progress—*homo economicus*. The essential accusation of the Great Refusal is directed against the subordination of human experience to the economic processes of the consumer society and its increasingly more absurd products, to the aggressive militarism that at least in our case has become so tightly interwoven with this society, and to the gigantic, impersonal organizations through which it all functions."

The ramifications of this conflict go much further than has been indicated so far. The kind of educational system and educational goals a society sets up, the way it handles the problem of poverty, the priorities it gives to aesthetic considerations, the extent to which it considers its citizens' needs for communion with nature, the uses of leisure it fosters—all these aspects and many more are affected by the image of man held by the society. Currently in our society a potent emerging force pushes for a change in that image, in the direction of transcendent man; but thus far the power remains on the side of the reductionists.

THE CRISIS IN AUTHORITY

If the issue of the image of man is crucial but unobtrusive, the issue of authority is immediately and obviously before us. Recent decades have witnessed the hastening erosion of the authority of the parent, the teacher, the scholar, the church, the law, and the state. Today's youth deeply question the meaning of the nation's policies and apparent aims. We need only to remind ourselves of the changes, within a generation or two, in the connotations of the military uniform, the American flag on foreign soil, the policemen's badge, the draft card, and patriotism.

This issue essentially concerns the balance between authority based on [illegible]er and authority based on voluntarily given respect. The central fact of today is that a significant fraction of the population, largely blacks and youth, have concluded that established authority on national and local levels is illegitimate—that is, it does not adequately represent their interests, and it is not based on trust, nor on a general consensus.

Varied is the speculation as to how this erosion of legitimacy of authority came about. Flacks (1969) lists and analyzes its possible origins and correlates; his list, supplemented by a few items from other sources, includes:

1. Widespread decline of commitment to "middle-class values" and to the capitalist ethic, while political and institutional elites continue to represent themselves in those traditional ways
2. Rapid growth of a sector of the middle class whose status depends on high education rather than on property, and who tend to be critical of traditional capitalism and skeptical about the sanctity and benevolence of established authority
3. Child-rearing practices by that group, and by significant minority cultures, that have cultivated doubts about established authority
4. Extension of education, leading to increased feelings of competence, self-esteem, efficacy, and potency, which in turn emphasize self-awareness rather than socialization as a suitable guide to behavior
5. Transformation of the American family in the directions of greater equality, encouragement of self-expression and autonomous behavior, and fewer parental demands for self-discipline
6. The Prohibition experience in particular and, more generally, widespread disregard of laws restricting private sexual behavior and of other sumptuary laws
7. Stringent punitive laws regulating marijuana usage, while such usage is considered by a rapidly increasing minority (adults as well as youth, teachers as well as students) to be a desirable substitute for the cocktail (a repetition of the Prohibition experience)
8. Increased distrust by Negroes, arising from liberal promises they view as unkept, and from experiences that repeatedly reinforce their conviction that the system is biased against them
9. Harrassment of blacks and hippies by police
10. Reaction to the unpopular draft and to the "immoral" Vietnam war
11. Specific incidents of dishonesty (e.g., 1959 television quiz show scandals, Eisenhower's denial of U-2 spying, Stevenson's U.N. denial of Bay of Pigs plans)
12. Lowering of faith in integrity of scholars and scientists (because of university involvement in military research, "quantification" and "dehumanization" of the social sciences, misinformation they have provided regarding marijuana and LSD)

Flacks provides several generalizations about the problem of maintaining the legitimacy of the authority structure:

1. Individuals tend to attribute legitimacy to authority when the exercise of that authority is perceived as beneficial to groups, individuals, or values to which those individuals are committed. Legitimacy tends to be eroded if members of minority subcultures experience a persistent pattern of inequity, or if groups perceive significant discrepancies between their goals and those of the larger society.
2. Attribution of legitimacy is a function of trust, which in turn depends on such matters as the objectivity of the authorities in mediating conflicts, the implementation of equality before the law, the openness of the political system to dissenting views, the trustworthiness of statements made by national leaders, and the degree to which officially espoused policies are actually implemented.
3. Individuals tend to attribute legitimacy to authority if they perceive a generalized consensus supporting legitimacy.
4. A person's sense of competence, potency, and efficacy is related to his response to different kinds of authority. Persons with a low sense of competence will tolerate authoritarian power; for those with high competence the legitimacy of authority depends on the degree to which they have access to the decision-making process, or believe that their judgments are taken seriously by their superiors, or have the freedom to shape their own situations without reference to higher authority.

These considerations suggest that the development of a sense of legitimacy of established authority and the restoration of the image of America as a provider of moral leadership and as an advancer of civilization are among the most urgent national educational tasks of today. They are tasks not just for the schools, but for the law enforcement agencies, for the political leadership, and for the polity as a whole.

The Crisis in Economic Values

I discussed this crisis earlier so it requires only brief mention here. The essential issue is the extent to which economic values shall be deemphasized and values that are *noneconomic,* at least in the strict sense, shall be a part of our operative (as contrasted with declared) values. The issue is central to resolution of the revolutionary ferment. It becomes specific in spelling out the goals for program budgeting, in listing the benefits in a cost-benefit analysis, in evaluating achievement of educational objectives, in deciding what kinds of educational experiences shall be offered out of public funding, or in planning for continuing education. If one is persuaded that education has any capability at all to change values, the issue becomes a crucial one for the schools: What values shall be fostered?

The Crisis in Pluralism

A simple society can have a single culture; a complex modern civilization such as the United States cannot. Thus the question is not whether we shall have a multimodal culture with a variety of behavior patterns and norms in different socioeconomic, educational, religious, and ethnic groups—no doubt we shall. Rather, the real question is whether we shall have mutual hostility and exploitation of weaker groups by stronger ones, or whether we shall have mutual respect and cooperation among diverse groups.

In a recent essay entitled "Psychology and the Social Order," Lawrence Frank wrote about the challenge of this issue:

> A social order which tolerates such wide-ranging pluralism of norms must seek unity through diversity. This means recognizing and cultivating differences while simultaneously enlisting people's loyalty and allegiance to a core of conduct and relationships. Only education and persuasion, not force, can build a social consensus out of these massive and varied elements.... Social change and improvement must come through the concert of a population composed of individual personalities.... Instead of relying chiefly upon legislation, as in the past, we (must) begin to think how each person may become self-consciously aware of his role as a participant in his social order.

The issue of pluralism with respect to subcultures arises in the educational world most directly over such specific questions as Black Studies programs and community control of schools. In broader form it lies behind the more specific issues in teacher strikes and student rebellions.

8

Implications For Education

I warned in the beginning that no matter what the title of this paper might suggest, I would not attempt to predict the future and to deduce from that future what the schools should do. Rather, I said that it was my hope to provide a useful framework for thinking about the future as it takes form through the events of the present.

Thus, this last section is brief, attempting only to demonstrate how the considerations I have raised in the earlier portions of the paper bear on educational issues.

Educational Goals

The basic issue for education is the choice of goals; all else follows this. For this statement to be meaningful, "choice" must refer, as I defined it previously, to a commitment of psychic, human, and economic resources in a particular direction. In that sense the choice is not necessarily what the society or its leaders may *declare* it to be. The choice is, rather, *inferred from where the society puts its resources.*

Let me move one step further and argue that the implicit choice of

goals can be inferred from the outcomes. Few will want to go all the way with that statement, but it contains an important germ of truth. Evidence mounts that in multifold subtle and unconscious ways humans communicate more than they consciously mean to communicate, and influence events in ways they do not consciously intend. Classical examples are the "Freudian slip" and the self-fulfilling prophecy. Thus, if we find that the operations of the school system tend, in fact, to perpetuate class differences with overrepresentation of Negroes and Mexican-Americans in the under class, we are forced to consider the question of whether or not this is an implicit, if largely unconscious, intent.

This is mainly to say that the goals of the educational system are much more a function of the choices society has made or is making than they are a consequence of the declarations of educational leaders.

When George Counts in 1932 issued the inspiring challenge, "Dare the schools build a new social order?" an appropriate answer might have been, they can't. The social order can barely build new schools. On the other hand, if society were to move in the direction of the "person-centered" society as discussed earlier, the educational system would undoubtedly bear great resemblance to that advocated by Counts, Dewey, and G. Stanley Hall.

Looking at this issue in another way, choices of educational goals are made in society on at least three levels. First, society itself makes a pervasive choice regarding the overall direction of its movement (such as those discussed earlier). This choice tends to establish constraints on what, in the long run, will be fostered, tolerated, or opposed. A movement within the school system that is not aligned with the general drift of the larger society, for instance, is unlikely to persist.

Second, society makes a decision as to what tasks will be assigned to educational institutions and what tasks to others. For example, the fostering of socially desirable attitudes toward authority might be a task divided between educational institutions and law enforcement. The development of a wholesome self-image in the child might be assigned in some proportion to the institutions of education, religion, and psychotherapy. These first two types of choices are made largely *outside* the educational institutions.

Finally, in accordance with the resulting context, choices are made as to what the more specific objectives shall be, with what priorities they shall be carried out (that is, what resources shall be allocated), and in what manner they shall be accomplished. These choices are determined partly within and partly outside the educational institutions.

As this typology of choices makes clear, if the society moves more or less in the direction of the "second-phase" industrial society, we can anticipate that increased emphasis will be placed on the role of education in accomplishing social goals and alleviating social problems (poverty, racial discrimination, challenges to national prestige, environmental deterioration, etc.). There will be strong reliance on "behavior-shaping" approaches, involving the detailed specification of desired behaviors to be imparted by contingency-management techniques. This work will be based on a sound behavioral-science infrastructure. The roles of evaluation and credentialling—i.e., assessing suitability for the various vocational and professional tasks society requires for its functioning—will probably remain important. Continuing education, in the form of vocational retraining, will also have an important place.

On the other hand, the extent to which the "person-centered" orientation becomes dominant in the society at large will be reflected in the schools. Educational goals that will be emphasized in such a society include teaching students to become effective thinkers and learners, and developing their inquiry and problem-solving skills, social skills, and emotional awareness and self-identity. Attention will be diverted from achieving behavioral objectives and will be placed instead on establishing conditions for spontaneous learning. Education will be designed especially to foster feelings of safety and trust, to promote freedom to explore and inquire, and to provide a responsive environment and directed challenges. Reduced emphasis will be placed on absorbing specialized information and on developing specific vocational skills. Less attention may also be given to grading, credentialling, and otherwise labeling persons.

Michael argues that drastic changes in education are necessary if we are to be prepared for the future:

> We must educate for empathy, compassion, trust, nonexploitiveness, nonmanipulativeness for self-growth and self-esteem, for tolerance of ambiguity, for acknowledgement of error, for patience, for suffering.
>
> In the first place, those social-aid roles, the roles that are meaningful because they relate a person to a person, require such capabilities.... The other reason for deliberately undertaking this kind of education is that those who will have the tasks of planning and leading must have a far deeper feel for and understanding of themselves as selves and as a part of other persons, other selves, than they usually do today.... Without such educated, sensitized, emotional resources, leaders will continue to be too rigid, too defensive, too remote from themselves and thereby from others to have the flexible and bold state of mind that will be needed to cope humanely and imaginatively with plans and turmoil, order and disorder. It will take special efforts indeed to en-

> large the emotional underpinning of those who recruit themselves to use the social technologies needed to run a complex society. (1968, pp. 109-111)

Unfortunately, significant changes in education do not come as direct consequences of such rational arguments. Only if the whole society shifts, for whatever subterranean reasons, toward a less economic and more humanistic orientation, are we likely to see much shift in education toward the goals described in Michael's plea.

PLAUSIBLE EDUCATIONAL TRENDS

Thus, while there is considerable evidence that educational goal priorities are changing, such a change is inseparably linked to more inclusive social meta-issues. Various other possible educational trends, described in the various writings on education for the future, deserve comment:

1. *Expanding fraction of the populace involved in education, and an expanding fraction of the national income going to education.* This will no doubt be true no matter where in the range of plausible futures we find ourselves heading. The nature of that education, however, will be vastly different depending on whether we move toward the "person-centered" society, the "second-phase" industrial society, or a period of violence followed by a garrison state.
2. *New conscious role for education to play in accomplishing social goals and alleviating perceived social problems* (national prestige, poverty, social order, racial conflict, etc.). This, again, will probably be true whichever future we select, but what the social goals are and what role education plays (e.g., maintaining social class differences vs. accelerating social mobility) will depend on society's overall direction.
3. *Increasing involvement of education with, and functional relationship to, other social institutions.* The balance between this trend and the countertrend toward autonomy and community control of schools and toward diversity and free choice among schools will be much influenced by how values shift.
4. *Extension in duration of the educational period*, both through early-childhood education and through more education for adults in the form of postsecondary schooling, vocational retraining, continuing education, parent education, and family education. Again, the overall trend is probably to be expected for any of the plausible futures, but what is done with those additional educational years will be very much determined by which path society takes.
5. *Extension of education to industry, community, and home.* Again, the form this takes will depend greatly on educational goals.
6. *Concurrent replacing sequential arrangement of education and work as we move into "the learning society."* One moving force is the

rapidly decreasing half-life of occupational skills. Another, in the "person-centered" future, is the synthesis of mind-forming work and educative episodes as the central activity of a self-rewarding life.

7. *Increasing departure from traditional methods of instruction.* It seems clear that classroom and lecture schools as we know them are a thing of the past. However, the overall future direction society takes will determine whether the new methods emphasize the application of educational technology to realize systematization, economy, and efficiency in achieving behavioral objectives, or whether the methods emphasize creating new opportunities for individualized learning and open-ended growth.
8. *Competition reduced by individualized programs* is a possible trend for which there is considerable pressure. Whether it materializes depends very much on which alternative future the society adopts. Competition as a stimulus toward excellence has salutary effects. On the other hand, in some forms it operates to lower self-respect and self-expectations, and conflicts with educational goals.
9. *Increasing fraction of educational costs will be obtained and distributed on a national basis,* since this seems necessary to even approach equality of educational opportunity. This trend is not necessarily incompatible with strong local control of schools.
10. *Extension of power and control to new groups*—teachers, students, minority groups, etc. This represents a long-term trend in society in general. The rapidity with which the power sharing takes place is related to the resolution of the pluralism issue. The extent to which a student shall have control of learning content and sequence depends on how the issue of educational goals is resolved.
11. *Increased blurring of the distinction between vocational and academic education*, quite possibly to the point of eliminating narrow vocational training from elementary and secondary schools altogether. Pressure will continue to rise to eliminate labeling students as inferior who are placed in vocational training courses.
12. *More differentiation of learning-facilitation roles* (teaching assistants, aides, etc.). This seems a likely trend with any of the alternative futures.
13. *Movement toward an atmosphere of shared learning, nonauthoritarian attitudes, mutual respect between teachers and learners, and deprofessionalization.* This is a possible trend compatible with the "person-centered" society, but not with more authoritarian futures.

EDUCATION'S NECESSARY TASK

The temptation is strong in us to ignore forecasts of unpleasant events. As students began to use psychedelic drugs, many observers predicted that if attempts were made to stop drug use through punitive legislation, all the ills of Prohibition days would be an inevitable consequence. Yet this knowledge failed to avert the adoption of exactly that course.

Similarly, forecasts of environmental deterioration, population pressures, traffic congestion, famine, Third-World uprisings, radioactive waste, agrichemical contamination, water pollution, and a host of similar social problems signal inevitable trouble ahead. Yet we procrastinate. If the analysis of "unsolvable macroproblems" in chapter 2 is accurate, these troubles will not be avoided by the usual muddling through. A drastic and rapid shift in orientation is imperative, on the part of the entire industrially developed segment of the world. Nothing less than a new guiding philosophy will do.

Ferkiss outlines three basic and essential elements for such a new philosophy. First is what he terms a "new naturalism," which affirms that man is absolutely a part of a nature, a universe, that is always in the process of becoming. The second element, "the new holism," recognizes that "no part can be defined or understood save in relation to the whole." The third, "the new immanentism," sees that the whole is "determined not from outside but from within." It follows from these points that meaningful social policies must be ecological in character; that is, they must be based on a recognition that any decision, any change, affects everything in the total system. Men's actions and the forces they set in motion are all part of the developing whole: "Every part of the whole has power and influence; every living particle is a source of direction and life." If man is to acquire the necessary sense of responsibility for the impact of his own actions on the shaping of the whole, he "must so internalize these ideas and make them so much a part of his instinctive world view that they inform his personal, political and cultural life" (1969, pp. 250-254).

At the same time Ferkiss and others point to the urgent need for a new guiding philosophy, there appears to be increasing espousal of the Perennial Philosophy premises, which are completely compatible with the elements of Ferkiss' philosophy. Whether this seemingly spontaneous emergence of a new outlook is fortuitous coincidence or the result of an unconscious response to a subliminally perceived need of society is a moot but unimportant point. In either event, the coincidence of the need and of the emergence of a possible answer to the need increases the likelihood that such a value shift will take place.

If, indeed, the foregoing analysis is sound and the challenge of the times is as I have represented it, then it appears that responding to this challenge is an educational task of the highest priority. Not all of this response must necessarily come from the schools alone. To be sure, all of us need to educate ourselves:

1. To emotional as well as intellectual awareness of the ineluctable

fact that we are one race, on one planet, and that only we can take responsibility for the fate of both and for the stewardship of the future

2. To the shift in basic premises and operative values necessary for a tolerable future, and to the evidence that such a shift is also congruous with the essential nature of human beings
3. To the realization that even if such a transition is made, the strains on the social structure in the decades just ahead will be of such magnitude that a strong binding force will be required to hold it together

In the first two points, changes are implied for the individual that will invoke participation of feelings as well as intellect. It is not enough to be intellectually aware that at this point in history nationalism is a suicidal course, or that it would be desirable for people to be differently motivated. Emotional and conative faculties must also be engaged.

If these two points are to be implemented, educational experiences must be contemplated that are akin to psychotherapy in that they aim at bringing the individual into closer touch with himself. Through such experiences the individual would make his own discoveries resulting in (1) a *felt* realization that the world must be inseparable and (2) a *felt* shift in the most basic values and premises on which he builds his life. In a sense, this means bringing into the educational system something like the "person-changing technology."

Education to develop an ecological point of view is education toward total sensibility. This is radical doctrine. It is a step not to be made lightly, nor in the absence of the third component.

Stated bluntly, the third point means the nation will require in the years just ahead a strong system to maintain order and to dispense justice. To establish such a system, the image of the policeman as an oppressor, which is presently held by a large segment of the population, must be reversed. Instilling the counterimage of the police as a fair and upright force preserving our delicate and hard-won social values will not be easy. It is a common task for the educational system to carry out together with the forces for law and order.

The schools will have to communicate an appreciation of the need to preserve and protect our democratic institutions, and a portrait of the law enforcement officer as the protector of individual rights and safety. Of course, the portrait must be accurate, which implies that the enforcement agencies must reform the recruiting and training of their officers. Equal protection must be accorded to all, regardless of skin color or hair style. Finally, the community must be educated to demand and pay for such a select police force.

To implement these three points is no small educational task. From present signs, there is little likelihood that the nation will undertake it. Nevertheless, such a course of action seems to be necessary.

Concluding Remark

In summary, one fruitful way to look at our changing society is as a society in the process of choosing: among alternative futures, among alternative belief-and-value systems, between ennobling vs. debasing images of man, and among means of restoring some sense of coherent authority.

At the very least, the educational planner needs to keep attuned to the trends in this choosing process. In this regard, we are at a crucial point in history. The forces for radical change are growing rapidly; the counter-forces likewise. Events of the next few years may very well portend the general direction of movement for decades to come. It is for this reason that I have devoted a significant portion of this paper to an interpretation of the manifest revolutionary forces.

Idealism and concern run strong in educators. Those who wish not only to fit in with the future, but also to participate in the choosing of it, need to understand what is at stake in the choices—the "issues beneath the issues"—and how those deeper concerns relate to the more specifically educational issues. This paper has aspired to be, in some small way, a partial guide to such understanding.

Bibliography

Ali, Tariq, ed. *The New Revolutionaries: A Handbook of the International Radical Left.* New York: William Morrow, 1969.

Baier, Kurt, and Rescher, Nicholas. *Values and the Future.* New York: The Free Press, 1969.

Becker, Ernest. *Beyond Alienation: A Philosophy of Education for the Crisis of Democracy.* New York: George Braziller, 1967.

Becker, Ernest. *The Structure of Evil: An Essay on the Unification of the Science of Man.* New York: George Braziller, 1969.

Bell, Daniel. "Notes on the Post-Industrial Society." *The Public Interest,* no. 6, Winter 1967, pp. 24-25.

Bell, Daniel. "Notes on the Post-Industrial Society." *The Public Interest,* no. 7, Spring 1967, pp. 101-118.

Bell, Daniel, ed. *Toward the Year 2000: Work in Progress.* Boston: Beacon Press, 1969. Also *Daedalus,* Summer 1967.

Bennis, W. G., and Slater, P. E. *The Temporary Society.* New York: Harper and Row, 1968.

Boulding, Kenneth E. "The Emerging Superculture." In *Values and the Future,* edited by K. Baier and N. Rescher. New York: The Free Press, 1969.

Boulding, Kenneth. *The Meaning of the 20th Century: The Great Transition.* New York: Harper and Row, 1964.

Brzezinski, Zbigniew. "Toward a Technotronic Society." *Current* 92 (February 1968): 33-38.

Calder, Nigel, ed. *The World in 1984.* 2 vols. Baltimore, Maryland: Penguin Books, 1965.

Carey, James T. *The College Drug Scene.* Englewood Cliffs, New Jersey: Prentice-Hall (Spectrum), 1969.

Chase, Stuart. *The Most Probable World.* New York: Harper and Row, 1968.

Chomsky, Noam. *American Power and the New Mandarins.* New York: Pantheon, 1969.

Conant, James Bryant. *Shaping Educational Policy.* New York: McGraw-Hill, 1964.

Cremin, Lawrence A. *The Genius of American Education.* New York: Vintage Books, 1965.

Curtis, R., and Hogan, E. *Perils of the Peaceful Atom.* New York: Doubleday, 1969.

Drucker, Peter. *The Age of Discontinuity.* New York: Harper and Row, 1968.

Drucker, Peter. *The End of Economic Man.* John Day, 1939.

Ellul, Jacques. *The Technological Society.* New York: Alfred A. Knopf, 1967.

Etzioni, Amitai. *The Active Society: A Theory of Societal and Political Processes.* New York: The Free Press, 1968.

Eurich, Alvin C., ed. *Campus 1980: The Shape of the Future in American Higher Education.* New York: Delacorte Press, 1968.

Ewald, William R., Jr., ed. *Environment for Man: The Next 50 Years.* Bloomington, Indiana: Indiana University Press, 1967.

Ewald, William R., Jr., ed. *Environment and Change: The Next 50 Years.* Bloomington, Indiana: Indiana University Press, 1968.

Fantini, Mario D., and Weinstein, Gerald. *The Disadvantaged: Challenge to Education.* New York: Harper and Row, 1968.

Ferkiss, Victor C. *Technological Man: The Myth and the Reality.* New York: George Braziller, 1969.

Flacks, Richard E. "Protest or Conform: Some Social Psychological Perspectives on Legitimacy." *Journal of Applied Social Science*, vol. 5, no. 2, 1969, pp. 127-150.

Foreign Policy Association. *Toward the Year 2018.* Cowles Education Corporation, 1968.

Frankel, Charles. *Education and the Barricades.* New York: Norton, 1968.

Fromm, Erich. *The Revolution of Hope: Toward a Humanized Technology.* New York: Bantam Books, 1968.

"The Future of the Humanities." *Daedalus*, Summer 1969.

Gabor, Dennis. *Inventing the Future.* London: Secker and Warburg, 1963; Penguin Books, 1964.

Galbraith, John K. *New Industrial State.* Boston: Houghton Mifflin, 1967.

Galbraith, John K. *The Affluent Society.* Boston: Houghton Mifflin, 1958.

Glasser, William. *Schools without Failure.* New York: Harper and Row, 1969.

Glazer, Nathan. "For White and Black, Community Control Is the Issue." *New York Times Magazine*, 27 April 1969.

Goodman, Paul. *Compulsory Mis-Education and the Community of Scholars.* New York: Vintage Books, 1962.

Goodman, Paul. *Growing Up Absurd.* New York: Vintage Books, 1956.

Green, Thomas. *Work, Leisure and the American Schools.* New York: Random House, 1968.

Harrington, Michael. *The Accidental Century.* London: Penguin Books (Pelican Series), 1966.

Heilbroner, Robert L. *The Future as History.* New York: Grove Press, 1960.

Heilbroner, Robert L. *The Great Ascent.* New York: Harper and Row, 1963.

Helmer, Olaf. *Social Technology.* (Delphi Predictions). New York: Basic Books, 1966.

Henry, Jules. *Culture Against Man.* New York: Random House, 1963.

Hirsch, Warner. *Inventing Education for the Future.* San Francisco: Chandler Publishing Company, 1967.

Hutchins, Robert M. *The Learning Society.* New York: Praeger, 1968.

Huxley, Aldous. *The Perennial Philosophy.* New York: Harper and Brothers, 1945.

Huxley, Aldous. "The Politics of Population." *The Center Magazine* 2 (March 1969): 13-19.

Jacobs, Paul, and Landau, Saul. *The New Radicals.* New York: Vintage Books, 1966.

Jencks, Christopher, and Riesman, David. *The Academic Revolution.* Garden City: Doubleday, 1968.

Jungk, Robert, and Galtung, Johan, eds. *Mankind 2000.* London: Allen and Unwin, 1969.

Kahn, Herman, and Wiener, Anthony J. *The Year 2000: A Framework for Speculation on the Next 33 Years.* New York: Macmillan, 1967.

Keniston, Kenneth. "The Sources of Student Dissent." *Journal of Social Issues* 23 (June 1967): 108-137.

Keniston, Kenneth. "You Have To Grow Up in Scarsdale To Know How Bad Things Really Are." *New York Times Magazine*, 27 April 1969.

Keniston, Kenneth. *Young Radicals.* New York: Harcourt, Brace & World, 1968.

Kennan, George F. *Democracy and the Student Left.* Boston: Little, Brown, 1968.

Keppel, Francis. *The Necessary Revolution in American Education.* New York: Harper and Row, 1966.

Kerber, August, and Smith, Wilfred. *Educational Issues in a Changing Society.* Detroit: Wayne State University Press, 1962.

Kimball, Solon T., and McClellan, James E., Jr. *Education and the New America.* New York: Vintage Books, 1962.

Leonard, George B. *Education and Ecstasy.* New York: Delacorte Press, 1968.

Lieberman, Myron. *The Future of Public Education.* Chicago: Phoenix Books, 1960.

Lipset, S. M. *The First New Nation.* New York: Basic Books, 1963.

Mack, R. W. *Transforming America: Patterns of Social Change.* New York: Random House, 1967.

MacLeish, A. "The Great American Frustration." *Saturday Review*, 13 July 1968, pp. 13-16.

Maslow, A. H. "Eupsychia—the Good Society." *Journal of Humanistic Psychology* 1 (1961): 1-11.

Maslow, A.H. "A Theory of Metamotivation: The Biological Rooting of the Value-Life." *Journal of Humanistic Psychology*, Fall 1967, pp. 93-127. Reproduced in Sutich, A. J., and Vich, M. A. *Readings in Humanistic Psychology*. New York: The Free Press, 1969.

Matson, F. W. *The Broken Image: Man, Science, and Society*. New York: George Braziller, 1964.

Mayhew, Lewis B. *Higher Education in the Revolutionary Decades*. Berkeley: McCutchan Publishing Company, 1967.

McDermott, John. "Technology: The Opiate of the Intellectuals." *The New York Review of Books*, 31 July 1969, pp. 25-35.

McEvoy, J., and Miller, A. *Black Power and Student Rebellion*. Belmont, California: Wadsworth, 1969.

McHale, John. *The Future of the Future*. New York: George Braziller, 1969.

McLuhan, Marshall, and Leonard, George B. "The Future of Education: The Class of 1989." *Look*, vol. 31, no. 4, 21 February 1967.

Means, R. *The Ethical Imperative*. New York: Doubleday, 1969.

Mendel, A. O. "Robots and Rebels." *The New Republic*, 11 January 1969, p. 16.

Michael, Donald N. *The Next Generation: The Prospects Ahead for the Youth of Today and Tomorrow*. New York: Random House, 1965.

Michael, Donald N. *The Unprepared Society*. New York: Basic Books, 1968.

Morphet, Edgar L., and Ryan, Charles O. *Prospective Changes in Society by 1980*. Designing Education for the Future, vol. 1. New York: Citation Press, 1967.

Morphet, Edgar L., and Ryan, Charles O. *Implications for Education of Prospective Changes in Society*. Designing Education for the Future, vol. 2. New York: Citation Press, 1967.

Morphet, Edgar L., and Ryan, Charles O. *Planning and Effecting Needed Changes in Education*. Designing Education for the Future, vol. 3. New York: Citation Press, 1967.

Morphet, Edgar L., and Ryan, Charles O. *Cooperative Planning for Education in 1980*. Designing Education for the Future, vol. 4. New York: Citation Press, 1968.

Mumford, Lewis. "Technics and the Nature of Man." *Nature*, 4 December 1965, pp. 923-928.

Mumford, Lewis. *The Transformation of Man*. New York: Harper and Brothers, 1956.

National Commission of Technology, Automation and Economic Progress. *Technology and the American Economy*, vol. 1. February 1966.

National Industrial Conference Board. *NICB Report*. Experimental Forecast for 1968.

Nowlis, Helen H. *Drugs on the College Campus*. New York: Anchor Books, 1969.

Oppenheimer, M. *The Urban Guerrilla.* Chicago: Quadrangle Books, 1969.

Peccei, A. *The Chasm Ahead.* New York: Macmillan, 1969.

Pines, Maya. *Revolution in Learning: The Years From Birth to Six.* New York: Harper and Row, 1966.

Platt, John Rader. *The Step to Man.* New York: John Wiley and Sons, 1966.

Polak, Fred. *The Image of the Future.* Leyden, Netherlands: A. W. Sijthoff, 1961; New York: Oceana, 1961.

Prehoda, R. W. *Designing the Future.* Philadelphia: Chilton Book Co., 1967.

Rafferty, Max Lewis. *What They Are Doing to Your Children.* New York: New American Library, 1968.

Rescher, Nicholas. *Value Considerations in the Public Policy Issues of the Year 2000.* Santa Monica, California: RAND Corporation (P-3884), 1967.

Roszak, T. *The Making of a Counter Culture. Reflections on the Technocratic Society and Its Youthful Opposition.* New York: Doubleday, 1969.

Sanford, Nevitt, and Katz, Joseph. *Search for Relevance.* San Francisco: Jossey-Bass, 1969.

Spender, S. *The Year of the Young Rebels.* New York: Random House, 1969.

Tart, Charles, ed. *Altered States of Consciousness.* New York: John Wiley and Sons, 1969.

Taylor, Harold. *Students without Teachers: The Crisis in the University.* New York: McGraw-Hill, 1969.

Teilhard de Chardin, P. *The Future of Man.* New York: Harper and Row, 1964.

Theobald, Robert. *An Alternative Future for America.* Chicago: Swallow Press, 1968.

Theobald, Robert. *The Challenge of Abundance.* New York: New American Library, 1962.

Theobald, Robert, ed. *Social Policies for America in the Seventies: Nine Divergent Views.* New York: Doubleday, Anchor Books, 1969.

Trist, Eric. "Urban North America: The Challenge of the Next 30 Years." Unpublished paper delivered to the Annual Meeting and Conference of the Town Planning Institute of Canada, June 1968.

Vaizey, John. *Education in the Modern World.* New York: McGraw-Hill, 1967.

Ware, Caroline; Panikkar, K. M.; and Romein, J. M. *The 20th Century.* History of Mankind: Cultural and Scientific Development, vol. 6. New York: Harper and Row, 1966. Prepared under the auspices of UNESCO.

Waskow, Arthur I. *Notes from 1999.* New York: New American Library, forthcoming. Reviewed in *Futurist,* August 1968. Summarized in *New University Thought,* vol. 6, no. 3 (Spring 1968).

Wheeler, H. "Bringing Science under Law." *The Center Magazine* 2 (March 1969): 59-67.

Young, Michael. *The Rise of the Meritocracy, 1870-2033.* London: Thames and Hudson, 1958; Baltimore: Penguin Books, 1967.

Part II

Teacher Militancy: Implications for the Schools

Richard C. Williams

9

Introduction

Decisions in public education emerge through a structure consisting of several groups that have fundamental and sometimes conflicting interests in the schools. These groups can be divided into three overlapping categories: the public, the professionals, and the pupils. Each of these groups can be considered according to their formal and informal participation in school decisions (Green 1969).

Formal participation of the public occurs through state and local school boards and state and national legislative bodies. Informally, the public affects the schools through parent-teacher associations, taxpayer groups, political action groups, and various other special interest groups formed to influence educational programs.

The professionals influence the schools in their formal roles of teachers and administrators; informally, they exert pressure through teacher organizations and other professional and special interest groups.

Although pupils never really have participated formally in school decision making, through student government and other officially recog-

nized organizations they have consulted in a quasiformal manner on matters affecting the schools. Informally, they play a major role in influencing the social system of the school (Gordon 1957).

Traditionally, each of these three groups has been allocated a special role in educational policy making: The formal public groups consider the public interest and translate it into policies by which the schools operate; the educators translate the public policies into specific school programs; and the students are generally limited to offering recommendations about decisions that affect them.

While this allocation of roles and authority generally has been adhered to by the three parties, instances of overlap abound. That is, school board members have involved themselves in the day-to-day operation of the schools, educators have attempted to make policy, and students increasingly have resorted to collective actions, even disruptions, to make their influence felt.

The informal components of each group—taxpayer groups, teacher organizations, student pressure groups, etc.—have faded in and out of the process. By definition, they have never been legitimated and thus lack assurance that their concerns will be included in formal deliberations.

For a variety of reasons this entire decision-making structure is under pressure to change. The pressure is being applied on two levels. Those who occupy the formal decision-making offices are asking that authority be redistributed; teachers, administrators, and students at this level are seeking a larger slice of the decision-making pie. Accordingly, school boards are being asked to surrender some of their authority.

Meanwhile, at the informal level, minority parent groups, emerging student power groups, and others are insisting that the schools become more personalized and flexible. They advocate redesigning the traditional organizational structure into a less bureaucratic and more responsive system.

Past legitimate attempts to substantially reallocate power and authority in public education usually have been unsuccessful. Of the several explanations for this, two stand out: One, those who control the machinery whereby changes can be implemented have a vested interest in maintaining the status quo, and, two, those who propose changes in the system seldom offer workable alternative plans.

Met with growing frustration, these formal and informal groups increasingly have sought to achieve their goals by turning to militancy. Parent groups responding to such issues as racial integration and sex

education often have resorted to telephone campaigns, picketing the schools, badgering school boards, and sit-ins. Educators have called in sick, picketed the schools, and gone on strike. Students have walked out of the schools, disrupted board meetings, published underground newspapers, and rioted.

These militant efforts of parents, professionals, and pupils are alike in being guided by a common desire to change the basic decision-making structure of public education. The groups conflict, however, over who they would like to see emerge as the new dominant force in educational decision making.

The conflict, for example, between the informal public group and the informal teacher group is an underlying cause of the Oceanhill- Brownsville controversy in New York City (Mayer 1969). The current struggle on many campuses across the country can be seen as a conflict between the formal public and the professional decision-making structure on the one hand and the informal student group on the other (Frankel 1968).

This struggle for control of the educational process and the resulting strife have far-reaching implications for the future of American education. In this paper I examine one element of this struggle, teacher militancy, and its implications for the schools. By limiting the topic to teachers, I do not deny the importance of other militant groups struggling to change the schools. Certainly any comprehensive examination of the present upheaval in education must consider the interactions among all the various participant groups. Therefore, wherever possible, teacher militancy will be considered within the larger milieu of educational conflict.

The discussion of teacher militancy will be approached as follows:

Chapter 10	The present level of teacher militancy will be examined. A brief discussion will follow of why teachers have been successful in defying the law in their militant actions.
Chapter 11	Conditions affecting teacher militancy will be explicated. The conditions will be subdivided into two categories, external and internal.
Chapter 12	Alternative models for involving teachers more effectively within the decision-making framework will be presented. The models to be discussed include a modified hierarchical model, the union model, and the academic model.

Chapter 13 These three models will be analyzed in terms of their potential influence in the schools, constraints on their adoption, and the resultant probability of their acceptance.

Chapter 14 The paper will be summarized briefly, the direction for further research on teacher militancy will be outlined, and some projections will be made on the implications of teacher militancy for the future of American education.

10

Level of Teacher Militancy

To define operationally the level of teacher militancy in America remains an elusive task. Militancy can be defined in a number of ways, so that a consensus as to what is meant by militant behavior seems impossible. Even if one could operationalize the term, it would be difficult to generalize about teacher militancy on a nationwide basis. Local differences arise from such factors as geographical area, intensity of population, percentage of male teachers, financial support of education, and local issues of concern to teachers. The relevant literature includes no national study of the level of militancy in America that adequately considers these factors.

One index of teacher militancy is the number of teacher strikes. The NEA research staff (1968) recently compiled some statistics that paint the picture vividly.

Teachers went on strike 114 times during the 1967-68 school year. These strikes accounted for 80 per cent of the estimated teacher man-days lost due to work stoppages since 1940, and represented more than one-third of the 295 teacher strikes in the past 28 years.

The 1960's have brought a rapid increase of teacher strikes. The number of strikes per school year are:

School Year	*No. of Strikes*
1960-64	Less than five per year
1964-65	12
1965-66	18
1966-67	35
1967-68	114

Attempts to mitigate the militant behavior of teachers through legislation have not been particularly successful. Presently, strikes by public employees are outlawed by statute or precedent in all 50 states. Yet teachers seem to be able to break the law with impunity, or at least with a minimum fear of legal retribution.

The explanation rests not on any negligence or lack of fortitude by politicians or law-enforcement agencies, but on the prevailing logic that has made nonviolent civil disobedience an effective tool for social change. The power and influence of teacher militancy can be best understood by seeing how civil disobedience gives teachers a powerful weapon for affecting the operation of the schools, both at present and in years to come.

Smythe (1967) provides a framework that explains why and when civil disobedience can be used successfully to gain concessions in collective bargaining. He suggests five conditions that support the efforts of a group of employees to force concessions from their employer. These five conditions are briefly summarized as follows:

1. Employees must be irreplaceable—either their skill must be so specialized that they cannot be replaced or their employers do not dare replace them.

2. Employees must be essential to the operation of the organization, i.e., the organization must be unable to function in the absence of the employees.

3. The cost of continued disagreement must exceed the cost of agreement—dissension must be too damaging to management for it to allow the impasse to continue.

4. Employees must be aware that they possess the three strengths above. That is, they must realize that they are irreplaceable and critical to the operation, and that continued disagreement will be more costly to the employer than the proposed agreement.

11

Conditions Affecting Teacher Militancy

ANY assessment of the impact of teacher militancy must begin with an examination of those factors that affect the level of teacher unrest. One can expect a continuing escalation of militancy unless the conditions giving rise to it are properly dealt with by changes implemented in the schools. It is important that such changes be directed at the real problems. Continuing to raise teachers' salaries, for example, will not reduce teacher militancy if its underlying source is not inadequate pay but lack of professional participation in decision making.

The literature on teacher militancy and its sources is expanding. The search for ideas uncovers an array of research studies, knowledgeable opinions, and random speculations. For discussion purposes the following review of the conditions affecting teacher militancy has been subdivided arbitrarily into those conditions that are external to the teaching profession and those that are internal. This division in no way implies that the factors do not interact. Indeed, the opposite is likely. The conditions affecting teacher militancy are many and they interact in a complex and elusive manner. So far, no comprehensive effort to study the inter-

5. Employees must be sufficiently militant and cohesive to bring effective pressure on the employer. The employer must realize that the employees will "hit the bricks," if necessary, to force their demands.

The power of an employee organization to achieve its goals through striking is directly related to the degree to which the employees possess these characteristics. Teachers fit the criteria quite adequately:

1. Teachers are difficult to replace. The various states have credential laws that restrict the use of noncredentialed teachers in the classroom.

2. Teachers are critical to the operation of the schools. Unlike some industries, the schools are not automated sufficiently so that supervisors could keep the schools operating in the teachers' absence.

3. Any continuing teacher strike that closes the schools brings increasing pressure from the public to settle the impasse. Few school boards can withstand the prolonged attack of a citizenry demanding that their children return to school.

4. Teachers are increasingly aware of the power of strikes and civil disobedience as means of gaining their goals. The lessons of labor unions in private industry and of the civil rights movement have been dramatically taught to teachers.

5. Teachers are becoming more militant and cohesive as evidenced by the statistics on the rising number of teacher strikes.

Thus, teachers do possess a tremendous collective potential to alter the operations of the schools. Recent events indicate that they intend to use it.

action of these conditions, or the process of that interaction, has been completed. Thus, any attempt to identify those conditions must be somewhat subjective.

External Conditions Affecting Militancy

External conditions include those events and developments in the society that impinge on the teacher's role in the schools. Three will be discussed briefly.

CIVIL DISOBEDIENCE

The lessons of civil disobedience and the successes of those who have used it have not been ignored by teachers. In recent years the use of militancy as a means of achieving social change has gained greater acceptance in American society (Miller 1966, Posey 1968, Stinnett 1968). As militancy has become more acceptable, teachers have grown more willing to strike. An NEA research survey (1968) reported that the percentage of teachers who believe teachers should strike, at least under certain circumstances, rose from 53.3 per cent in 1965 to 68.2 per cent in 1968.

AMERICAN LABOR MOVEMENT

A mutual attraction has developed between the American labor movement and the teaching profession. The labor movement's success in improving the compensation and working conditions of its members has made unionism an attractive alternative for teachers who seek similar goals.

The declining percentage of the labor force involved in the union movement makes white-collar workers, including teachers, a fruitful source of new members (Lieberman and Moskow 1966, Stinnett *Turmoil* 1968). In addition, the legitimacy of the labor movement, first in the private sector and more recently in the public sector, has made the union model more attractive to teachers as a means for reshaping the organization of education. Just as the Wagner Act of 1935 authorized bargaining between unions and industry, the various collective negotiation statutes passed by the legislatures of a number of states have legally sanctioned efforts by teachers to negotiate collectively with boards of education (Lieberman and Moskow 1966).

DISSATISFACTION WITH SCHOOLS

The American public traditionally has believed that the quality of its life is directly related to the effectiveness of its public schools. Perhaps

nothing so matches the public's discontent with societal life today as its conviction that the schools are not living up to their potential. Many people, including educators, feel that the schools are not making their appropriate contribution to society (Green 1969). Few agree, however, on how schools can be made more valuable and productive. The recent clash in Oceanhill-Brownsville is a prime example of two groups wanting to make changes but having significantly different views of what the changes should be.

Green relates the increased dissatisfaction with the schools to the increased employment opportunities now open to minority groups. When securing an education might pay off in a better job, people tend to want the schools to be good, and criticize them when they are not. When the door to economic opportunity slams shut, educational attainment loses its importance and people become apathetic about the schools.

What is important is that a climate of dissatisfaction creates an environment in which it is easier for teachers to effect change. If most people were satisfied with the schools today, then the public would be more likely to resist the efforts of teachers to change them (Zeluck 1969).

The situation is complicated by the fact that teachers have been receiving the brunt of the public's condemnation of the schools. Teachers generally consider this unfair. They say major decisions regarding the schools are made by school boards, administrators, and the public (Gittell *Community* 1968). Moreover, teachers emphasize that they long have advocated increased freedom to teach, more financial support for the schools, and fewer nonteaching duties. The public, by its lack of support for these improvements, must assume, according to teachers, a major share of the blame for the schools' failures. Uniting in the face of public censure, teachers have tended to oppose public attempts to solve educational problems by disenfranchising teachers or by limiting their prerogatives (Corwin *Teacher* 1968 and Goodwin and Carlto 58).

Internal Conditions Influencing Teacher Militancy

Internal conditions contributing to the rise of teacher militancy are those that apply inherently to the teaching profession. Some of these conditions, of course, apply not only to the teaching profession. The problem of professionals in organizations, for example, is not unique to teaching.

CHANGING CHARACTERISTICS OF THE TEACHING PROFESSION

A number of changes in the demographic composition of the teaching

profession have strongly influenced the development of teacher militancy (Lieberman 1956).

Doherty and Oberer (1967) have documented the increased percentage of men in the teaching profession. This has resulted from both an intensified effort to recruit men into the profession and a lower male turnover rate. While the number of women teachers increased 38 per cent in the decade 1954-64, the number of men increased 93 per cent (Doherty and Oberer 1967). Today men constitute the majority of teachers in senior high schools and represent an increasing percentage in elementary and junior high schools (NEA 1965).

This change from a female- to a male-dominated profession has had an enormous impact on the evolution of teacher militancy. Several studies have documented the dissatisfaction felt by men in teaching (Beharka 1969, Maas 1968, Strom 1967, Tobiason 1967). Zeigler (1967) argues that teaching has been considered traditionally a feminine role. Male teachers are expected to play a subservient role to administrators and school boards; male teachers work in one of the few occupations where there is no financial discrimination against women; male teachers do what society considers a woman's job and they are paid a woman's salary for it.

The influence of this male role conflict on teacher militancy is summarized as follows by Zeigler:

> In short, men teachers and women teachers are different animals, and the remarkable political behavior of men teachers can be understood as a masculine reaction to their feminine occupational role. (1967, p. 17)

The male teacher, in addition to being paid an inadequate salary, is trapped in a vocational dilemma. He is constantly confronted by a public, particularly students, who refuse to respect his male status. Yet if he wishes to attain an administrative or leadership position, he must undergo additional training. The result is summarized by Zeigler:

> High schools (are) staffed with teachers who do not like their work, who espouse an ideology of discontent, and who reject the educational orthodoxy of this educational establishment. (1967, p. 27)

A second factor contributing to teacher militancy is the lowering turnover rate of teachers (Rabinowitz and Crawford 1960). When people stay in an occupation, they usually value the opportunity for advancement. The teaching profession is unique in being structured so that a teacher can be promoted into a leadership position only by moving into some administrative role. However, as indicated, the teacher must pursue addi-

tional academic work to compete for only a limited number of administrative openings. Many teachers find this an unattractive and unjust route simply to be allowed to partake in educational decision making.

Another factor is the increased preparation of teachers. The percentage of teachers who lack the bachelor's degree has dropped from 22.2 per cent in 1956 to 4.7 per cent in 1968 (Corwin *Anatomy* 1968). In addition, the introduction into the schools of such innovations as new curricular programs (new math) and new teaching techniques (computer-assisted instruction) gives teachers an expertise not found among the general public. This specialized knowledge enhances the teacher's claim as an educational "expert."

Finally, Corwin (*Anatomy* 1968) suggests that the normal generation gap between older administrators and younger teachers is widening because of the different ways the two groups view the problems of the schools. Older administrators tend to identify those problems in terms of improper classroom instruction and inefficient central-administrative practices. The younger teachers, on the other hand, have been educated in a more sociological orientation. They tend to view the school problems as consequences of a faulty social system. This divergence of viewpoint has intensified the conflict between the two groups, which in turn has increased teacher militancy.

INADEQUATE TEACHER COMPENSATION

Probably the single most often mentioned cause of teacher militancy is the teachers' quest for more equitable salaries. Research reported by Wildman (1967), based on a national survey of 6,000 large school systems, indicates that salaries are one of the main items in negotiations (see also Knapp 1968 and NEA 1969).

Many studies have shown that teachers are underpaid. A recent study of teachers' salaries in the U.S., for example, reported the average salary paid to teachers in 1968-69 was $8,194. In the spring of 1967, when the average annual cost of living for an urban family of four was $9,076, the average salary paid classroom teachers was $6,830. Even allowing for nine-month employment, the average teacher's salary dips far below what it would be if based on the teacher's age, experience, and education. The study concludes that teachers, by working for substandard salaries, might be viewed as personally underwriting one-eighth of the cost of public education in America (NEA 1969, pp. 28-33).

Furthermore, Woodring (1967) has suggested that statistics based on mean salaries can minimize the seriousness of the problem. He feels that a major inequity of teacher salary schedules is their tendency to "tele-

scope." That is, whereas the salaries of beginning teachers have risen sharply in recent years in response to the pressures of supply and demand, salaries at the top of the scale are not so responsive and have increased at a slower rate. Thus general statements about the inadequacy of teacher salaries are even more true of experienced than beginning teachers.

PROFESSIONALS IN THE ORGANIZATION

As American society becomes more complex, the talents of professionals are utilized increasingly within complex organizations (Kleingartner 1967 and Lieberman 1956). Many definitions of "professional" have been elaborated, yet few have improved on the one offered by Flexner in 1915. He defined professionals as those who perform "intellectual operations with large individual responsibility; they derive their new material from science and learning; this material they work up to a practical and definite end; they possess an educationally communicable technique; they tend to self-organization; they are becoming increasingly altruistic in motivation" (p. 904).

Whether teaching can be classified as a profession remains an unsettled question (Cheek 1967). As Becker (1953) observed in an earlier study, teachers desire that administrators treat them as colleagues and respect their prerogatives on curricular and instructional matters.

More recently, Corwin (1963) reported the impact of professionalism in the public schools. He administered scales that measured employee orientation and professional orientation to 284 teachers in Ohio and Michigan. He then compared the level of conflict in a school with the professionalism of the staff. As Corwin had predicted, a positive relationship was found between the level of professionalism and the level of conflict in the school. He concluded that professionalism enhances militancy.

The point is that teachers increasingly are viewing themselves as professionals. This trend toward professionalization likely will increase the tension between teachers and school management, resulting in greater militancy.

The conflict between administrators and teachers as professionals is traceable to several causes: the distrust teachers have of those who are responsible for evaluating their performance but who are viewed as lacking the competence to do so; the allegedly different emphasis administrators assign organizational and administrative matters as opposed to high teacher interest in instructional matters; the developing use of a union model in education that heightens the basic conflict between labor and management; and the characteristic demand of large districts for routinization of functions within a bureaucratic framework.

Corwin summarizes the kinds of tensions as follows:

> Specialization gives employees power; the more specialized they are, the less competent are administrators and laymen to supervise and evaluate them. On the other hand, the more complex the organization, the greater the need for internal coordination, which enhances the power of administrators whose primary internal function is coordination. Lay control is challenged simultaneously by the development of both conditions; and at the same time the current development of specialization and complexity has fertilized the soil for conflict between administrators and professional employees. (1965)

Green (1969) provides a provocative discussion of the tensions between professional and lay control of the schools. He lists three value orientations that predominate in deciding the appropriate method of governing the schools: (1) managerial—the utility of the product to other institutions (Are schools turning out productive citizens who can serve industry and government?); (2) traditional—preserve the collective memory of the citizenry, develop the capacity for social recollection; and (3) humanistic—develop each individual to his fullest potential. He feels that the public will continue to emphasize the managerial while the professionals will emphasize the humanistic. The resulting lay-professional conflict will further contribute to teacher militancy (see also Boyan 1966, Goodwin and Carlton 1968, Gouldner 1959, and Woodring 1967).

Summary

A number of conditions in and surrounding the public schools have spawned a growing militancy among America's teachers. The demographic characteristics of those who populate the teaching ranks are changing. Teaching increasingly is being viewed as a professional career, which during the past 15 years has attracted an increasing percentage of males.

For a variety of reasons the new teaching cadre is frustrated. This frustration has at least three major sources: the difficulties of supporting a family on a substandard salary, the responsibility for educating the young without the authority to control the conditions that maximize learning, and the relinquishing of professional autonomy to school management in a way that seriously impairs teachers' attempts to become a true profession.

The educational process takes place in an increasingly shifting and volatile environment. Society's institutions are besieged by groups using violent and nonviolent disobedience to successfully achieve their goals.

With the consensus on national values and norms appearing to evaporate, the schools, which tend to reflect the norms of the society, are constantly being urged to change in a variety of conflicting directions in a futile attempt to satisfy the demands of a variety of disparate groups. The interaction of these conditions, plus the potential collective power of teachers to force their demands, presents a volatile condition characterized by a rising pressure for change.

12

Alternative Models For Teacher Participation

For the variety of reasons we have just reviewed, enormous pressure is being applied by teachers to improve their status. While still attempting to improve their economic position, they are waging a widening effort to increase their participation in making decisions that affect their professional lives. What seems abundantly clear is that the status quo can no longer withstand the escalating demands for change.

The ways school management has responded to this call for change have varied. In many instances attempts have been made to "democratize" the schools. Teachers have been included in administrative councils or in similar consultative roles. In some states, legislation has been passed to allow teachers to negotiate collectively with school boards. Under these laws teachers are permitted some means of determining who will represent them in negotiations with school management. Teachers also are allowed to negotiate collectively concerning matters of professional and personal concern. Although the use of collective negotiations is increasing rapidly, many states have not yet enacted such laws.

In this section I will describe four models that have been used to

resolve the problems of decision making by professionals: the self-employed professional model, the modified hierarchical model, the academic model, and the union model. The latter three are discussed further as alternative strategies for resolving the teacher demands for greater participation in educational decision making (Garbarino 1968).*

Self-Employed Professional Model

The self-employed professional model has served as the basis for decision making among the legal and medical professions in this country. It is discussed here because teachers often have compared themselves to these professions, especially when arguing for greater teacher autonomy in professional decisions. ("Does the patient decide what technique will be used in surgery?") The model is characterized as follows:

1. It consists of a group of individual practitioners who, through a mutually established code of ethics, set the standards for admission to the profession, define acceptable professional behavior, control internal affairs, decide who shall be expelled from the profession, and set fees.
2. Usually these professions are concerned about the relationship between the professional and the individual client. They do not have to work through or with an organization.
3. Their behavior and professional prerogatives are based on the assumption that the client is unable to make judgments about the affairs of skilled professionals. Thus they, the professionals, are in a position to demand autonomy in professional decision-making matters.

This model was not considered as an alternative means of increasing the involvement of teachers in the school's decision process because it does not seem likely that the public school will evolve into a system of individual professionals who teach students on a tutorial basis.

Modified Hierarchical Model

As the title indicates, this model is a modification of the basic hierarchical model. The basic hierarchical model differs from the self-employed model primarily because in the former the professional is em-

* Much of the content of this section is based on Garbarino's analysis. I have modified his terminology, however, by substituting "modified hierarchical model" for his "Employed Professional Model," and "academic model" for his "Ideal Academic Model."

ployed by an organization. The organization and its administrators mediate between the professional and his clients. This mediation has an enormous impact on the autonomy of the professional. No longer is he independent in making judgments about appropriate professional behavior and its evaluation. Employers substitute their judgment for his in such matters as schedule of work, employee compensation, assignment of duties, and professional treatment. Employers feel capable of making such judgments because their administrative representatives have professional training equal or superior to that of the employed professional.

Teachers have been employed almost exclusively under this basic hierarchical model. Other professionals, such as social workers and nurses, are similar to teachers in this regard, since their professional skills are also usually practiced within an organization. Increasingly, professionals who have been characterized in the past by the self-employed model are being employed in organizations. In these instances they inherit the problems attendant to such an occupational status.

Such professional employees are not, of course, solely at the mercy of their employers. Often the specialization of their work provides a shield against general administrative supervision. Collectively, moreover, teachers can equalize the power of employers through strikes, sanctions, lobbying, slowdowns, and mass resignations. Indeed, professionalism often is cited as the reason for defending illegal strikes by professionals in the public service. The argument hinges on the professionals' withholding their services because of conditions that force them to serve their clients in a manner that violates their professional standards.

Nor should the bureaucracy be considered entirely a negative force. Moeller (1962) reported that teachers in "low" bureaucracies experience closer supervision than their counterparts in larger bureaucracies. Thus the size of the organization may function to protect the teacher from outside interference.

A number of organizations, realizing the disadvantages of this model for their professional personnel, have modified it. The modified hierarchical model refers to attempts by the hierarchy to increase professionals' participation in the decision-making process without altering the structure of that process. The modified model, when applied to the schools, does not mean that school boards lose their ultimate authority over school policy, nor does it mean that administrators lose responsibility for determining how the board's policies will be implemented. What is different is that steps have been taken to make the hierarchical arrangement of the schools more palatable to teachers. Teachers are included, for example, in administrative councils or are formed into faculty clubs or building

organizations to advise the hierarchy about their concerns. No change is made in the distribution of power. Instead, teachers are consulted on matters that affect them.

Also in the modified model, a "human relations" orientation is desired in the behavior of school administrators. This behavior emphasizes administrator-teacher communications, democratic leadership, and interpersonal relationships. The rationale for this approach suggests that more humane administrative behavior can be an effective tool for reducing teacher dissatisfaction.

Academic Model

The academic model refers to the governing system that has been used, or aspired to, in many universities and colleges. It attempts to minimize conflict between professionals (professors) and the organization (university) by recognizing appropriate spheres of expertise and assigning appropriate roles to those most qualified to make academic and administrative decisions (Goss 1963).

The governing board of trustees or board of regents decides on public policy and serves as a buffer between the institution and the public. The administration in turn carries out the governing board's policies. Both the trustees and the administrators recognize the qualifications of professors to make major decisions on the form, structure, and content of the academic program. Accordingly, decisions about academic matters—i.e., what is acceptable scholarship, what are the characteristics that portray a scholar, what constitutes an acceptable program to develop an educated man—are delegated to the faculty.

For the academic model to be successful, the university must have a stable work force. The development of consistent and uniform policies regarding academic matters requires a low employee turnover rate. If the institution experiences rapid displacement of personnel, it seems unlikely that independent, responsible faculty policies would emerge. As a result, administrators or trustees likely would play a heavier role in developing and enforcing such policies.

Besides the delegation of responsibilities, another major distinction between the academic and the hierarchical models can be noted. The hierarchical model, at least in the public schools, requires that teachers receive specialized training in educational administration before they will be considered for a leadership position. The academic model contains no such requirement. University administrators, presidents, and deans move back and forth between the professorial and administrative ranks regardless of formal administrative training.

UNION MODEL

The union model is essentially a formal means whereby labor can affect the operation of a hierarchical structure. Whereas the hierarchical model assumes that the interests of managers and workers are similar and can be worked out through cooperative arrangements, the union model assumes a basic and permanent conflict of interest between management and labor. In addition, management is perceived under the union model as having extensive power, both legal and financial; the only way labor can hope to match this power is to band together.

In public education, school boards, administrators, and teachers usually share a common goal of developing and maintaining an excellent educational system. Beneath the common, overriding goal, however, are buried many conflicts. Teachers, for example, seek constantly to maximize the remuneration for their services. School boards, on the other hand, tend to interpret the teachers' interests according to their estimation of the district's ability to support salary increases. When this basic conflict is worked out through the hierarchical model, the board tends to prevail. That is, teachers are encouraged to tell the board the kind of salary scale they would like to have; the board listens; and then *it* decides what the final salary settlement will be. If teachers complain that the settlement is inadequate, boards usually respond that budgetary limitations forced them to settle as they did. This method of unilateral decision making on fundamental issues has existed in education for years under the hierarchical structure.

Those who support the union model contend that unilateral policy determination is unfair. In its place they propose a set of rules and regulations whereby teachers can negotiate collectively with management about fundamental decisions.

Under the union model teachers no longer merely consult board members on what they, the teachers, would like. Instead, the two parties sit down and negotiate their differences. The final decision is bilateral; that is, both parties to the contract must agree.

Once an agreement has been reached, the terms are stated in a written contract. The contract specifies the rules and regulations whereby the parties implement the terms of the agreement. Implementation often requires a grievance procedure to allow a party who believes that the other is not adhering to the provisions of the contract to have recourse through some legalistic appeal. The grievance procedure in turn often involves the introduction of a third party into the management process. If the parties reach an impasse regarding the new contract, an arbitrator, mediator, conciliator, or factfinder can be brought in to help settle the dispute.

The union model represents a fundamental departure from the normal prerogatives of management in public education. School boards traditionally have been considered agents of the state legislature and have heretofore refused to delegate their decision power either by negotiating with teachers as equals or by being bound to the judgment of a party who has not been elected by the people.

SUMMARY

Teachers' militant demands for changes in the decision-making structure of public education, coupled with their collective power for enforcing these demands, have brought public education to a crossroads. The present hierarchical system, it appears, will prevail no longer. In this section I have presented four alternative models for professional decision making, three of which were suggested as warranting serious attention.

The first of these models, the self-employed professional, was not suggested as a solution to public school problems since it is most unlikely that American schooling will evolve into a series of one-to-one teacher-student tutoring relationships.

When the professional is employed by an organization, he loses the autonomy he enjoyed while self-employed. Now administrators and supervisors assume the right to judge the professional's work. A major dilemma is created if the judgment of the supervisor is not in accord with that of the professional employee. The modified hierarchical model attempts to resolve the conflict through *consultation;* that is, the employee is encouraged individually or collectively to express his ideas and concerns to management. However, management retains the main decision-making responsibility.

The third or academic model was developed in higher education and represents a means whereby professionals can participate in institutional decision making. Although the final authority on administrative decisions is retained by boards of trustees and administrators, decision making under this model is separated into spheres of responsibility so that its functions can be *delegated* to those with the most expertise to make the relevant decisions. In the university the faculty retains major responsibility for the academic program, including student programs and faculty appointments and promotions.

The union model, the last one considered, allows faculty to participate in decisions by *negotiating* with management about matters that affect them. Agreements are reduced to written contracts and a procedure is initiated to enforce the contract. Often third parties or "outside" individuals or groups are involved in a judiciary capacity to resolve impasses.

13

Selection Of Appropriate Model

NUMEROUS factors should be considered when deciding which of the models would be most appropriate for elementary and secondary public education.

The models arose in different circumstances. The hierarchical model has been used for years in many public and private organizations; almost exclusively it has provided the organizational framework in elementary and secondary public education. Although the union model was developed in private enterprise, its use in public organizations has increased rapidly in recent years. The academic model has been limited to institutions of higher education, though a similar rationale exists in other organizations, like hospitals.

Each model tends to reflect the special characteristics of the organization in which it developed. Any attempt to evaluate the consequences of applying one of these models to public education must consider how the particular assumptions and characteristics of the model relate to the unique characteristics of the public schools.

School Characteristics

Below are summarized the traditional characteristics and presuppositions of public education. They are considered constraints that must be contemplated in adapting the models to public schools.

SCHOOLS REPRESENT A PUBLIC MONOPOLY

Traditionally, public schools have enjoyed a virtual monopoly over the allocation of public monies for education. The public school system is the largest school system in the United States. Attempts to alter substantially the pattern of public spending to increase support for private schools have been unsuccessful.

While public spending for materials, equipment, and facilities in private schools has increased, the overwhelming percentage of public resources in education still is spent on public education. The resulting monopoly has limited drastically the options available to parents who seek alternative educational opportunities for their children. Unless they have sufficient private resources, parents have no choice but to send their children to public schools.

UNDEFINED CLIENTELE

A lack of consensus exists as to who is the client of the public schools. Some claim that the parent is the client. As such, the parent hires the school as a surrogate to carry out his wishes, since he realizes it is more economical and efficient to train and employ specialists (teachers) to perform the parental function of educating the child.

Others insist that the client is the child and that it is the school's responsibility to do what is best for the child, even if this means the school will occasionally conflict with parental wishes.

Musgrove and Taylor summarized this distinction when comparing the English and American systems:

> The American system (of schools) is "democratic" in the sense that education expresses the will of the people; the English situation is "democratic" in the sense that it offers the maximum opportunity to children to escape their local world; the former offers justice to the parents, the latter justice to children. (1969)

A compromise between the two positions suggests that the client shifts as the child advances through the system. In this view, the parent should be the client in the elementary grades; but as the child approaches maturity and earns a stronger voice in his education, attention should be shifted from parental wishes to those of the child.

DEMOCRATIC PRINCIPLES MUST PREVAIL

The schools as public institutions must scrupulously assure all clients and employees of equal treatment. The organization must constantly defend itself against charges that it favors one group of clients or employees over another.

Accordingly, school systems tend to standardize their educational programs and personnel administration. Any innovation or attempt to individualize treatment leaves the organization vulnerable to criticism that it is not treating its employees or clients equally.

This assumption has implications, for example, for any system that rewards teachers on a merit plan. Because public monies are involved, teachers want assurance that differentiated salaries are based on merit and not on the extent to which teachers agree with the administration. Unless such assurances can be offered, teachers tend to resist merit plans.

WIDE PUBLIC EXPERIENCE WITHIN THE ORGANIZATION

Most adults have spent many years in school and have met a variety of teachers. The activities of teachers, therefore, are familiar to the public. This fact makes teaching quite different from most other professions. People usually have limited contact, for example, with doctors, lawyers, engineers, plumbers, auto mechanics, and social workers.

Whereas most people feel unqualified to evaluate the performance of a doctor or a plumber, the public generally, because of its vast experience with teachers, does consider itself competent to judge teacher quality and to comment intelligently on activities in the school. Nearly everyone, in short, considers himself capable of making valid judgments about schools and teachers. It is noteworthy that teaching is one of the few licensed occupations wherein laymen constitute the majority of members on governing and licensing boards.

Many laymen question seriously whether increased teacher participation in decision making will result in better schools (Gittel *Teacher* 1968). Persons taking this point of view believe that teacher self-interest will prevail when teachers participate in decision making.

In addition, there is a resurgence of the demand for community control of schools, especially in the ghetto. According to this argument, professionals have had their chance and have failed, leaving increased parental control of the schools the only way to attack the problems of urban education.

DIFFICULTY IN EVALUATING THE PRODUCT

The impact of a school or a teacher on students is difficult and elusive

to measure for a number of reasons. The schools have diffuse and often conflicting objectives. Many factors influence a student's success besides the school, e.g., academic aptitude, home environment, health, parental support, student peer norms, and attitudes. Relevant indices of success do not appear for many years after graduation—voting record, success in work, creative ideas, etc. Nor is it easy to prove a linkage between the school's activities and the success of its graduates. As a result, merit systems or schemes to relate expenditures to success are difficult to defend.

SPECIALIZATION OF FUNCTION

Teachers, especially in secondary schools, are specialists in their subject matter. The number of specialties in a given school is usually large; thus any attempt by a general supervisor to judge a teacher's product is immediately suspect. Although parents and administrators may feel themselves competent to judge teacher performance, teachers are skeptical at best.

Let us now examine how the suggested models relate to these constraints so that we can better understand their probable influence on public education.

Modified Hierarchical Model

Since this model has predominated in public education for many years, one would expect it to be well suited to the constraints imposed by the traditional public school system.

The public has tended to regard the schools as surrogates that, for reasons of efficiency and economy, are charged with carrying out parental wishes. Viewing teachers as possessing no special expertise, the public regards itself as qualified to participate heavily in school policy and decision making.

Teachers in public education have lacked an experienced, highly educated, and forceful leadership to challenge the public's demands to operate the schools. The hierarchical model has not encouraged the development of such a leadership.

Because the schools serve many publics, yet are public monopolies, there must be some way of resolving parental conflicts in the best interests of the majority. The public, in short, must play a major, decisive role in the making and implementing of public educational policy. The hierarchical system, with publicly elected boards of education, has allowed the maximum participation of the public in the operation of the schools.

The hierarchical model has additional characteristics that recommend it. It presupposes cooperation between labor and management; hence it

tends to minimize or suppress the development of internal conflict. Rosenthal summarizes this tradition nicely: "... administrative doctrine emphasizes the harmony of interests and the agreement on goals that supposedly exist among administrators and teachers. Start with these vital ingredients, add a pinch or two of consultation and stir well with humane administration.... " (1969, p. 9)

It is reasonably efficient. That is, the unilateral nature of the decision process can produce decisions in a way that avoids the time-consuming consultation or negotiation required by the other models.

As might be expected, however, the model is under heavy attack from teachers. Their concerns spring from a number of changing conditions that severely test the continued use of this model as the predominant organizational structure in public education. One new condition is the higher percentage of experienced and highly trained male teachers. In the absence of this professional corps, it was easy and perhaps appropriate for school boards and administrators to decide school policy unilaterally. But the emergence of this new corps poses a severe test to traditional compliance patterns.

Second, the teacher's job has become more complex. With the addition of new curricula and techniques to teaching, the ability of the public to know and to judge the schools is decreasing. Third, the control of educational policy in urban centers has tended to shift from public to bureaucratic hands. Because of limited time and lack of independent staff assistance, school board members have had to rely on information and recommendations from central administrators (Gittell *Teacher* 1968).

In view of these changes in the schools, it appears unlikely that minor modification through increased teacher consultation, democratization of administrative behavior, or both, will be very effective. Teachers, at least in many instances, will no longer be satisfied with the consultative role. To increase teacher participation by elaborating on that role does not strike at the core of the problem. Teachers want not only to advise, but to decide. Likewise, it seems unlikely that anv human-relations approach will compensate for a paltry pay check.

Several writers have espoused the need for a basic change in the schools' decision-making structure. One of the earliest and most influential was Lieberman: "The most important causes of the ineffectiveness of public education are rooted in its anachronistic and dysfunctional power structure" (1960).

Lieberman argues that the tradition of letting the public determine both the ends and means of public education has resulted in the general inef-

fectiveness of today's schools. He further believes that basic educational reforms must be carried out by teachers themselves. Others have arrived at similar conclusions.

Boyan suggests that teacher participation be split into two categories: administrative-teacher participation in extraschool associations in "the development of organizational policy on salaries and extrinsic conditions of work"; supervisory-teacher participation "as professional colleagues in the organization, on organizational decision-making in education as an expert domain" (1966, p. 16).

Lane, Corwin, and Monahan suggest also that "the teacher's professional authority will be in jeopardy until it is supported by the structure itself" (1967, p. 145).

Academic Model

In the academic model, decisions are separated into categories so that authority and responsibility for decisions within each category can be delegated to those having the greatest expertise. The trustees retain responsibility for general policy formation; the administration attends to the organizational, financial, and structural concerns; and the faculty determines the academic program, including selection of students and hiring, evaluation, and promotion of personnel.

Madden (1969) differentiates between two forms of collective bargaining in education and relates them to trends in school organization. Drawing from Walton and McKersie (1965), he distinguishes between distributive and integrative bargaining. Distributive bargaining is based on a win-lose orientation. That is, if one party to an issue achieves his goals, he does so at the expense of the other. Usually the solution takes the form of a compromise whereby each party gains and gives. It is a mechanism suited primarily to the resolution of conflict.

Integrative bargaining is used when a possibility exists to increase the shares of *both* sides. The parties to the agreement seek alternatives that will increase the total shares held by each. Integrative bargaining is primarily a problem-solving technique.

Using Etzioni's (1961) analysis of complex organizations, Madden posits that distributive bargaining is appropriate in an organization pursuing economic goals (such as a business) and that integrative bargaining is appropriate in an organization pursuing cultural goals. Although the schools fall primarily within this latter classification, the fact that teachers depend on the schools for their livelihood adds a secondary goal that is economic. To account for this difference in goals, Madden suggests

that economic issues such as salaries and fringe benefits be resolved through distributive bargaining while instructional matters be decided through integrative bargaining.

Most negotiation in education today, however, is distributive, which tends to move the schools from a normative to an economic basis. Compromise, in addition, is often an inappropriate means for settling instructional and academic matters.

It is not clear in Madden's discussion exactly how integrative bargaining would operate in public education. What is suggested here is that the academic model, with its delegation of decision-making authority, might serve as a means of introducing integrative bargaining into public education.

An example will show how the model might be used. A persistent criticism of public education is that the social-studies curriculum is bland and poorly reflects the excitement of the social sciences. This criticism has much merit because the school program is essentially a compromise among parental groups who represent widely differing points of view on social issues. Teachers consequently shy away from topics that will excite public concern, and thus students are denied the most vital substance of the social sciences.

An academic model would give the determination of the social-sciences curriculum to faculty members. Such an approach might be viewed as integrative bargaining because most parties would benefit. Students would be given more relevant materials; teachers could more freely teach what they think is important; and many parents would be satisfied that the most relevant curriculum was being presented. Some parents might object, of course, that a particular point of view was not being reflected (Louis Harris Survey 1969).

Several writers have suggested that the academic model or a similar division of responsibility might be considered as a way of restructuring public education (Boyan 1966, Frankie and Howe 1968, Thompson 1965, and Woodring 1967). Boyan states:

> The need for two separate structures for teacher participation in school government is compelling. The first would encompass the participation of teachers as members of extra-school associations in the development of organizational policy on salaries and extrinsic conditions of work. The second would encompass the participation of teachers as professional colleagues, *in* the organization, on organizational decision-making in education as an expert domain. The first would permit teacher involvement via a bargaining or negotiations model in the development of organizational legislation. . . . The second would extend the classical participatory model to include *the right, as a right,* of teachers to

participate in organizational decisions on educational programs. (pp. 16-17)

By delegating responsibility for the academic program to the faculty, several problems are averted and several causes of teacher militancy are muted. Most important, teachers become involved in decision making. The decisions, for example, concerning the selection, evaluation, and promotion of teachers become the responsibility of teachers. Teachers would judge and be judged by colleagues instead of by supervisors or administrators.

The experience of evaluation in higher education indicates that teachers would be responsible in their evaluation. Perhaps most important, the academic model would at least provide a mechanism whereby *some* evaluation can take place. At present in public education little effective evaluation occurs. Few teachers are denied tenure, not because all teachers are good, but because administrators have neither the expertise nor the time to evaluate them. Administrators are understandably reluctant to press for the removal of teachers on limited evidence.

Besides attacking the problem of evaluation, the academic model minimizes conflict and distrust between administrative supervisors and their employees. It also keeps decision making and conflict resolution within the organization. External organizations or outside parties need not become involved in the school's "professional" affairs. In short, academic decisions are made on an academic basis, not on a political one.

Finally, by separating the spheres of decision making, a cooperative and problem-solving relationship between teachers and administrators is sustained. Common interests are maximized; the "good guys versus bad guys" orientation is eliminated. This cooperative point of view is important. For if the professional is to assert his claim to expertise on instructional matters, he must present a forceful and united front to those who challenge that claim. The inability or seeming unwillingness of administrators to support teachers in instructional decisions in the past has been due only partly to a value clash. More often it has resulted from the administrator's vulnerability. The power of the board and the public has not been balanced by an equally powerful and united faculty. The administrator simply has acceded to the greater power (Boyan 1966).

A number of constraints must be faced, however, when pondering the adoption of an academic model. First, the model as applied to higher education assumes the considerable professional expertise of the professor. The public usually has accepted the idea that professors are qualified to substitute their own for the public's judgment on academic matters.

However, the public does not attribute this level of competency to public school teachers.

Second, the question lingers, who is the client? If teachers are given the responsibility to judge educational programs, suppose their decisions conflict with the values or beliefs of parents. If the client is the child, then the professional's autonomy is enhanced. If the client is the parent, then the teacher is the public's employee and his actions must conform to parental directions.

Third, the monopolistic nature of the schools restricts the options available to parents who are dissatisfied with the school program. College students choose their school and attend voluntarily; if they become dissatisfied, they can change institutions or drop out. Public school children do not have these options. Until a certain age they are required to attend school, and usually they must attend a particular school prescribed by the district. Great public resistance would mount against any plan whereby children are required by law to attend a particular school and to subject themselves to an instructional program over which parents have no control.

Fourth, the academic model demands that a great amount of time be spent by teachers who are involved in the decision making. Public school faculty members likely will not relish the addition of large blocks of time to their normal teaching load. Either the classroom burdens of teachers would have to be lessened at tremendous expense, or the structure of the school would have to be altered drastically.

A final constraint against adopting the academic model arises from the enormous dissatisfaction with higher education felt by large segments of the public, including both parents and students. At least some of the parental dissatisfaction emanates from the autonomy that faculties have enjoyed. Some insist that the trouble in the university and even in society at large rests on the "revolutionary" ideas taught under the guise of academic freedom. On the other hand, many students suggest that the university is trailing the times because of the unwillingness of the faculty and administration to innovate. These reasons and others indicate that any attempt to refashion the public schools into an academic model can expect heavy public resistance.

Union Model

The union model, we recall, assumes a fundamental conflict of interest between labor and management that cannot be resolved through cooperation but only through negotiation and compromise. An agreeable com-

promise is reduced to a written contract and procedures are established whereby a party who feels that the contract is being violated can voice its concern and eventually present its case before an impartial body or power for adjudication.

ADVANTAGES

A major advantage of the union model is that it allows parents and teachers to codetermine the schools' operating policies and procedures. It recognizes, furthermore, that the two groups may express fundamental differences about school operations, and provides a mechanism whereby such differences can be resolved.

By recognizing the rights and privileges of both parties, the union model avoids many problems peculiar to the academic model. Recall, for example, that under the academic model the parental role is usurped by the schools and children are compelled to attend classes where the means and ends of instruction are determined by the professional. The union model provides a negotiations machinery whereby teachers are guaranteed that their concerns will be included in policy formulations. Teachers do not merely consult; they help make decisions.

The union model is characterized by the whole legal and historical tradition built up around it. Such questions as recognition, negotiation processes, impasse procedures, scope of negotiations, and appropriate unit representation, long have been recognized and dealt with in fields where the union model has been active (Lieberman and Moskow 1966).

DISADVANTAGES

The movement toward the negotiation of public-teacher differences is not an unmixed blessing. Often the basic assumption of a labor and management conflict tends to become a self-fulfilling prophecy, so that whatever natural cooperation and common interest may exist between the parties are deemphasized and replaced with distrust. Doherty and Oberer have observed of the AFT, the leading advocate of the union model:

> The AFT sometimes gives the impression of stridency—its criticisms of school boards, administrators, the "establishment" being characterized more by their shrillness than by their telling accuracy. The AFT has asked for, and appears to relish, the role of the abused underdog. . . . One finds in its literature, the monthly *American Teacher*, in its occasional publications, even in its new professional quarterly *Changing Education* . . . a sense of victimization that almost borders on the paranoiac. (1967, p. 29)

This basic assumption of ill will promises to exacerbate the difficulty of educational problem solving. Miller (1966) has observed that the

negotiation process itself tends to expand the distance between teachers and school management. Those who have fought across the bargaining table find it difficult to work cooperatively in solving problems.

The union model suffers also from the tendency of unions to evolve into essentially conservative organizations that replace their original concern for the public interest with a narrow self-interest. As Paton has observed:

> For historical and social reasons the vast majority of trade unionists are still preoccupied with bread and butter issues and, despite the efforts of some enlightened leaders, still show no interest in having the kind of freedom and responsibility in planning and executing their work which teachers, as professionals, want much more of than they have had hitherto. (1968, p. 563)

Another disadvantage of the union model is that the process of reducing the negotiated agreement to writing and of then establishing an elaborate machinery for enforcing the contract impinges severely on the schools' flexibility. If contracts in the schools follow those developed in private industry, it means the addition of detailed, mandated, and universally applied procedures and rules to the schools' already-burdensome bureaucracy. The motivations that lead many people into teaching cannot be easily reconciled with the complex, highly structured sets of rules, regulations, and grievance procedures that probably will develop (Wildman and Perry 1966). It is also highly unlikely that many capable administrators would like to assume the leadership position in a school whose operations have been severely limited by a contract, in effect reducing the job to that of a contract administrator (Doherty and Oberer 1967).

The union model further poses problems for education by bringing outside organizations into the schools' decision-making processes. It does so in two major ways. First, teacher organizations competing for members see the schools as their battleground. Each tries to outdo the other in gaining benefits for members without considering the accompanying responsibilities. This jurisdictional dispute can greatly complicate attempts to solve educational problems. One such problem has been that teachers are promoted and paid according to seniority, academic credit hours, and degrees, not merit. Ineffective teachers receive the same salaries as their more skilled colleagues. In a competitive environment it is unlikely that either the AFT or the NEA will press vigorously for more flexible tenure laws or some form of teacher evaluation. Still another problem posed by the competition between teacher organizations is the tendency for conflict to be institutionalized; that is, the power and prestige of organizational leadership are enhanced by a high level of conflict between the teacher organization and the schools.

Second, the union model implies that school boards will have to deal with outside parties. School boards are reluctant to delegate any of their authority to an outside party that has not been elected by the public. Also, several legal questions haunt negotiated agreements with teachers. School boards often claim, for example, that they have no authority to delegate their responsibilities (Nigro 1968).

Another potential problem with the union model is that the compromise as a decision-making technique does not always insure maximum rationality. Although a compromise on salaries may be appropriate, similar procedures are not always suited to such instructional matters as the introduction of a new curriculum.

Still another problem involves the strike. The monopolistic nature of the schools tends to undercut the traditional claim of unions to use the strike as an ultimate weapon. When teachers strike they leave their clients no alternative. Strikes have a much different effect in the private sector where the consumer can usually obtain goods and services from the competitors of a company affected by a strike.

Finally, the process of negotiations is time consuming. Both sides are required to carefully research their proposals, to formulate positions from which they will compromise, and to engage in lengthy and complex bargaining sessions. The process thus represents a deleterious drain of time and energy on both the administration and the teacher organizations.

14

Future Development Of Teacher Militancy

SPECULATIONS about the future of teacher militancy must take into account two important considerations. First, the future can be substantially altered by unexpected events. The New York teachers' strike in 1962, for example, has been labeled by many as a pivotal event in the development of the American Federation of Teachers and, subsequently, of the use of collective negotiations in public education. Second, public education encompasses millions of people in a variety of occupations in vastly differing environments; e.g., in differing sections of the country, in urban, rural, and suburban districts, in rich and poor areas. To generalize across differences as wide as these is hazardous at best.

Nonetheless, a number of readily observable trends in public education today prompt me to speculate about the future with some confidence.

The theme here has been that mounting unrest of teachers has forced the consideration of alternative methods of restructuring the administration of public education. Three possible models were suggested: hastily expanding the consultative role of teachers in public education (modified hierarchical); delegating appropriate portions of the decision-making

process to teachers (academic); or negotiating the differences between educators and the public and abiding by mutually written contracts that cover the entire operation of the school (union).

Teachers will not likely want to return to any hierarchical model, no matter how extensively their consultative role may be expanded or how much of an effort school administrators or school boards may make to soothe teacher frustration through human relations. Teachers have achieved notable victories by dealing with school management through other means. Concessions on salary raises and working conditions that were dismissed as unthinkable under the consultative process suddenly have become operational when teachers, uniting to force the issues, have won the right to negotiate collectively with management.

There is a discernible trend away from consultation. Moreover, even an increase in consultation likely would only slow the development of other forms of teacher participation in educational decision making.

Although the academic or delegative model has been used in higher education as a means of resolving the same problems that confront teachers in public schools, it does not seem likely that this model will become a viable alternative during the next decade. This is partly true because the university is under massive attack itself, and many question whether an academic model can govern an educational system. Though the demands for change in the university come largely from students and not from the public, the latter would likely oppose any suggestion that public schools become more like universities. Also, and perhaps more importantly, the academic model relies on widespread belief in the ability and expertise of faculties to make wise decisions regarding the academic program. The public neither has now nor within the next decade will likely develop such confidence in public school teachers.

The next decade most probably will witness an increasing use of the union model in the public schools. This prediction is based on the characteristics of public schools and teachers in contemporary America. The American public typically relies heavily on the schools to improve the quality of American life. Most parents view the school as the setting in which children are taught American traditions and prepared to compete in our economic system.

It does not appear that the American public is ready to delegate this fundamental responsibility to teachers. A belief is commonly shared that teaching is not a specialized field and that those who teach do not qualify as experts on the means and ends of education. Virtually all parents have had extensive contact with schools and teachers; consequently, they view the activities of a school as neither esoteric nor technical. Although the

level of teacher preparation may be rising and the training of teachers in programs such as team teaching and computer-assisted instruction may advance the teacher's claim to expertise, such developments likely will not alter basically the public's view, at least for a time.

In addition, parents view themselves, not their children, as the clients of the school. The school is seen as providing a service for parents who harbor little intention of delegating so basic a responsibility to teachers.

The public's reluctance to delegate responsibility coupled with teachers' demands for a larger decision-making role point to the union model as the most likely compromise between these two positions.

Implications of Adopting the Union Model

Caution must be exercised when estimating the implications of the widespread use of the union model in public schools. While certain characteristics of the labor movement may be observed in other contexts, these characteristics may or may not accompany application of this model to public schools. Nonetheless, these characteristics must be considered when determining the effects of that application on the educational system.

INCREASED CONFLICT POSSIBLE

The level of conflict may increase and possibly cause distrust between school management and teachers to rise correspondingly. The two groups thus will be pushed increasingly into adversary positions.

Although administrative support abounds for many teacher demands, such support probably will vanish and a split will divide what traditionally has been referred to as the educational profession. Such a split may not necessarily diminish the strength of the profession. In higher education, for example, administrators have been excluded from membership in the American Association of University Professors. However, a basic difference between higher education and the public schools should be noted. The gap between administrative and professorial roles is not as wide in higher education. One can move easily from professor to administrator and back to professor. Professors, in other words, are administered by professors who are temporarily wearing a different hat. This interchange of functions tends to prevent hardened lines of distrust growing between professor and administrator. In elementary and secondary education, where the lines between administrator and teacher are tightly drawn by standardized credentials, a permanent and possibly dysfunctional conflict could develop.

Bargaining itself creates an adversary relationship that is difficult to overcome and forget in the daily operation of the schools.

The possibility exists, however, that the high level of conflict that characterizes negotiations today—with labor and management viewing each other as irresponsible adversaries—will be a passing stage in the evolution of an "accommodation and commonality of interests." Following Carlton's lead, Evans (1969) has elaborated a sequence of stages through which collective negotiations can expect to pass. The first stage is nativity, during which teachers feel guilty about using militant tactics to achieve self-interest goals. The second is adolescence, in which teachers assume a "back to the wall" stance. Negotiations smack of adversity and hostility.

In the third, or mature stage, which is productive and cooperative, the "mode of operation maximizes mutual benefits." Evans views public education as currently ensnarled in a combination of the nativity and adolescent stages. Noting that many teachers view this as the ultimate stage, he warns that unless they progress into a more professional and responsible stage, they can expect mushrooming hostility from a public that will view them as villains causing the deterioration of the public schools.

FLEXIBILITY MAY DECREASE

If one examines the use of collective bargaining in the private sector, the possibility emerges that its application to public education may sharply reduce the flexibility of the schools, and particularly of administrators. While this may be a prime goal for some, the resultant impact may be quite negative. The process of reducing negotiated agreements to writing and of then establishing grievance procedures to enforce the contract can result in a very legalistic, formal, and structured work environment.

Such an environment may run counter to the motivations of many people who enter teaching. The history of unionism in private industry points to the possibility that eventually teachers will be discouraged from voluntarily staying in the school after a specified hour, or that the operation of certain machines or equipment in the school will be limited to a specified few.

The grievance machinery can be used to "tie in knots" the hands of administrators who seek to meet some emergency or to change the school program. Parents, administrators, or even teachers who seek basic changes in a school may experience frustration when told that their concerns cannot be considered "until a three-year contract expires." These conditions are in no way inevitable, but that they may occur is indisputable.

DECISION-MAKING STRUCTURE TO EXPAND

The decision-making structure will be expanded considerably to include

teachers and those who represent them. These new participants will inject a variety of views about what the priorities for spending public funds should be and about what policies will result in better schools. Pressure will mount to improve working conditions and to allocate a larger percentage of the budget to teacher salaries. The rationale is that added money will attract better people into the profession, thereby enhancing the quality of the schools. Although this might indeed happen, another possibility is that poor teachers merely will be paid more.

Any attempt to substantially increase teacher salaries should also carry a proposal to assure the public that some sort of evaluative and promotional schema will be developed to make pay commensurate with teaching performance. Whether such proposals will be forthcoming if a union model is accepted remains speculative. Under the combatant conditions existing between the AFT and the NEA, such proposals seem unlikely.

The importance of including a means for evaluating the quality of teacher performance has been stated clearly by Boyan (1966). If the growing power of teachers results in the extreme position that teaching performance cannot be evaluated, and if, therefore, a static seniority system is instituted, then the future of the schools and of the teaching profession is a source of real worry. If, on the other hand, a demand is heard to switch from a hierarchical to a collegial evaluation system, then the development of teacher power may result in a trend toward true professional status.

INCREASED TEACHER PARTICIPATION

Increased teacher participation in decision making has important implications for the development of a computer-based systems approach to educational management.

The development of a systems capability for decision making has been limited primarily to organizations whose management retains certain prerogatives. In private industry, for example, there is a distinct difference between those decisions in which labor participates and those in which it does not. Labor is typically involved in the determination of wages and working conditions. Management, on the other hand, has the responsibility for deciding such matters as product development, pricing policies, marketing strategies, and fiscal management. While there are overlaps—e.g., labor demands to participate in profit-sharing—management has a great deal of autonomy in deciding those matters that are considered its prerogatives.

Management in public education used to enjoy prerogatives similar to those enjoyed by its counterparts in private industry. However, the

press for teacher participation in decision making through a union model severely limits the freedom of educational management to make decisions. Teachers are demanding to participate not only in decisions about salaries and working conditions, but also in fundamental decisions concerning curriculum content, instructional methodology, certification of performance, fiscal management, and long-range planning.

The benefits or detriments of teacher involvement in such decisions are yet unknown. What can be stated confidently is that teacher involvement in fundamental decisions broadens greatly the number of factors that must be considered when adopting a comprehensive systems-management scheme.

ALTERNATIVES FOR AVOIDING MEDIOCRITY

Ultimately, the impact of the union model's adoption must be judged according to the quality of education that results. Will the model result in a narrow self-interest by teachers that will freeze the schools in a myriad of rules, regulations, and procedures resulting in continually deteriorating schools? Or will it result in teachers continuing to grow in responsibility and stature, making demands not only on the public and on school management, but on themselves as well to insure that the public schools are responsive, creative, and relevant?

It is difficult to discern any clear trends. But because the more rigid course might develop, it may be useful to speculate on the alternatives available to those who wish to hedge on such a possibility.

One alternative is for leaders in teacher organizations and school systems to try to move the union model from the adolescent to the mature stage. Such an attempt must presume a willingness to abandon the assumption of conflict between labor and management and to begin a cooperative and productive relationship.

A second alternative is to recognize that school districts differ in significant ways; therefore, the union model, while appropriate for many districts, may not be very effective in others.

In many states, statutes are being passed that allow teachers to negotiate collectively with school management. These laws apply to all districts in the state. Yet each state consists of a wide range of districts, rich to poor, rural to urban, high turnover to low turnover. The union model may not be appropriate in each. A rural district, for example, with a teaching force consisting predominantly of local housewives and beginning teachers who generally leave for larger districts after two or three years, might prefer some form of modified hierarchical model. On the other hand, a district with a generally homogeneous population that is in general agree-

ment as to the purpose of the schools, and featuring a stable, highly selected, and well-educated teaching staff, might be enticed to try the academic model.

Large districts characterized by heterogeneous populations, large teaching forces, many municipal agencies vying for tax dollars, and distinct groups demanding that the schools be changed, may find the union model most appropriate. Because the general application of the union model may encourage the development of inappropriate governing structures, some states might experiment with legislation allowing different models to be used within the same state.

Musgrove and Taylor (1969) suggest another possibility for resolving the teacher-public conflict. They suggest that parents should have a louder voice in determining educational ends, but that teachers should be given complete control over the selection of educational means. Musgrove and Taylor's solution to the problem is to allow school districts to develop several kinds of schools, each having clearly stated objectives that reflect a particular educational philosophy. In a given district, for example, school X may be identified as a traditional preparatory school, school Y may use a Montessori approach, and school Z may offer a Summerhill-type program. The means by which each school would achieve its stated objectives would be determined by the faculty. Parents would be free to send their children to any school they preferred. Teachers thus would continue to be delegated the responsibility for determining the means of achieving parents' chosen goals. In large districts this approach would entail complex transfer and transportation problems. In smaller multi-high school districts it may prove a workable alternative.

A final alternative is to move from the union model to a joint union-academic model. A joint model would allow teachers to make major decisions that affect the academic program and, at the same time, to negotiate collectively with the administration about salaries and working conditions. As a beginning toward this hybrid model, teachers and school management could search to uncover those decision areas that can be handled best by the respective parties, and could establish conditions whereby the delegation of authority might be completed.

One can argue, for example, that the major responsibility for the hiring, evaluation, and promotion of teachers can be handled best by teachers themselves. (The public must be assured, however, that teachers would be responsible in carrying out so important a task.) A scheme for delegating this responsibility to teachers could be negotiated with school management. A mutually acceptable plan then could be adopted, subject to periodic review by school management. This would seem to be a more

productive procedure than asking teachers to develop an elaborate tenure system to defend sometimes arbitrary and cursory administrative evaluation that virtually assures that no teacher will be denied tenure or be dismissed, regardless of how incompetent.

The Canadian experience demonstrates how this fusion of the union and the academic model might work.

The Alberta Teachers' Association (ATA), as noted by Kratzmann (1964), has been among the vanguard in developing a powerful, responsible, and effective teachers' organization. While many of its early activities concerned salaries and working conditions, the ATA has become increasingly dominant in professional decisions in the province. As Kratzmann acknowledges, comparisons across cultural lines are risky; nonetheless, American teachers might look to the ATA for guidance in developing a means of accommodating union and academic activities within the same organization.

In summary, the impact on the public schools of the probable adoption of the union model is difficult to determine. The movement is still very young; when applied to the unique characteristics of public education, it may differ considerably from its development in other contexts.

It is important that the relative value of the union model in education be weighed against the impact it has on the education of children. As Doherty and Oberer have stated:

> ... teachers are beginning to assert a much greater influence on how our schools are run, and we are witnessing just the beginnings of this movement. Nor is there likely to be any turning back. If teacher leaders and school officials learn to use this development wisely, it may prove to be the most therapeutic educational development of this century. If they do not, it may freeze into our system, more firmly than ever before, those personnel practices that can only lead to educational mediocrity. In either case, a rather profound change is taking place in the guardianship of public education. (1967, p. 125)

As a hedge against such "freezing," those charged with educational leadership should keep in mind alternative strategies to insure that the schools do not become mediocre. Strategies suggested were: a conscious effort by teachers, leaders, and managers to forestall possible undesirable aspects of the union model; legislation to permit different decision-making models to develop within the same state; establishment within the same district of schools possessing markedly different educational objectives; and the use of the union model to move public education toward a mixed union-academic model.

RESEARCH ON TEACHER MILITANCY

It is generally true that a lag develops between a new social phenomenon and the research that explains its sources and dynamics. America's teacher militancy movement is no exception.

The published research consists largely of dissertations. Although teacher militancy may be an interesting and productive line of inquiry for doctoral students, this research tradition seldom can be expected to provide any substantial addition to knowledge. (Doctoral dissertations tend to lack the financial and administrative support and the coordination necessary to accomplish large and systematic explorations of a topic. Dissertation research might be more effective if universities would cooperate to sponsor a series of studies guided by a common rationale, and would provide students with the financial support and guidance necessary to pursue really productive research.)

However, a few comprehensive studies have been undertaken to shed light on teacher militancy. Most have been mentioned previously and will be recalled only briefly here.

Wildman's survey (1967) of the 6,000 largest school districts provided original data on which additional studies should be conducted now. Of very high priority is the need for research on the impact of teacher militancy on the development of quality educational programs. The impact of the union model on American education is yet unknown. No evidence has yet revealed how educational programs will be affected by this movement. Outlines of the impact should emerge very soon; substantial research to document this development is imperative.

Research on the impact of teacher militancy implies several lines of inquiry and a variety of research strategies. Several needed projects are as follows:

1. Investigations into the scope and causes of teacher militancy must continue. Studies such as Corwin's and Zeigler's are examples of such research. Teacher militancy will not abate until the schools respond effectively to the concerns and demands of teachers. A number of questions must be answered. Are the levels and causes of teacher militancy static or dynamic? What is the relationship between school decision-making processes and the level of teacher militancy? What is the relationship between the characteristics of teachers and the level of militancy? Does the conflict orientation of the union model exacerbate the militant attitudes of teachers? Or does the cohesion and feeling of success that ac-

companies collective activity improve teacher morale and consequently improve the schools?

2. Documentation of the effects of the inception and growth of the union model is needed. Longitudinal case studies are needed in school districts employing this model. Questions need to be asked bearing on the implications of the model. For example, what is lost when details of the educational program are decided through compromise? What is gained through compromise? What happens to school budgets? Are brighter and more competent individuals attracted to the profession? Are schools more or less responsive to change? Is it more or less difficult to implement changes, such as integration of the schools or new curricula?
3. Attempts should be made to document carefully the use of alternative methods of resolving the teachers' need for more participation in decision making. What has been the result of the Canadian experience? Of the English experience? Has the academic model been adopted by any public elementary and secondary schools? By private schools? And what has resulted? Can the hierarchical model be modified to enhance its attractiveness? Is the public's attitude toward teachers changing? If so, what implications do the changes hold for the adoption of the alternative models?
4. Careful study should be focused on the demands by some parents and students to share more fully in educational decision making. What are the bases for their unrest? Are their demands consistent with or opposed to teacher demands? To what extent will the mutual efforts of parents, students, and teachers improve the schools? How can we characterize the direction of parental and student militancy? And finally, what is the impact on education of the conflict that exists among parents, students, teachers, and administrators?

We are entering a time of fundamental change in the decision-making processes of public education. Presently we can only conjecture about the impact that the shift from a hierarchical to a union model will have on educational programs. When conjecturing, however, we must be wary to shy away from either unbounded optimism or pessimism. As a result of the increasing teacher participation in educational decision making, schools may improve substantially or they may fail victim to conflict-ridden structures that lock the schools into a downward spiral.

What is needed most is careful research on the entire process of the

shift from a hierarchical to a union model, particularly its effect on the quality of the educational system. If such research shows the union movement resulting in improvement of teacher performance, more relevant educational programs, and greater pupil achievement, then the movement warrants further support and refinement. If, on the other hand, it indicates a continuing deterioration of the schools, then alternatives must be found.

Bibliography

Becker, H.S. "The Teacher in the Authority System of the Public School." *Journal of Educational Sociology* 27 (November 1953): 128-141.

Beharka, Charles H. "Teacher Organization Militancy: A Function of Teacher Militancy, Teacher Dissatisfaction, and Organizational Cohesion." Ph.D. dissertation, University of California, 1969.

Bidwell, Charles E. "The School as a Formal Organization." In *Handbook of Organizations*, edited by James G. March. Chicago: Rand McNally, 1965.

Boyan, Norman J. "The Emergent Role of the Teacher and the Authority Structure of the School." In *Collective Negotiations and Educational Administration*, edited by Roy B. Allen and John Schmid. Columbus, Ohio: University Council for Educational Administration and College of Education, University of Arkansas, 1966.

Cheek, Neil H. Jr. "The Social Role of the Professional." In *The Professional in the Organization*, edited by Mark Abrahamson. Chicago: Rand McNally, 1967.

Corwin, Ronald G. "The Anatomy of Militant Professionalism." In *Above the Salt: Militancy in Education*, edited by Harold I. Goodwin and Patrick Carlton, pp. 55-61. Morgantown, West Virginia: College of Human Resources and Education, West Virginia University, 1968.

Corwin, Ronald G. *The Development of an Instrument for Examining Staff Conflicts in the Public Schools*. Columbus, Ohio: U.S. Department of Health, Education, and Welfare, Cooperative Research Project Number 1934, 1963.

Corwin, Ronald G. "Professional Persons in Public Organizations." *Educational Administration Quarterly*, Autumn 1965, pp. 1-22.

Corwin, Ronald G. "Teacher Miltancy in the United States: Reflections on Its Sources and Prospects." *Theory Into Practice*, April 1968, pp. 96-102.

Doherty, Robert E., and Oberer, Walter E. *Teachers, School Boards, and Collective Bargaining: A Changing of the Guard.* Ithaca, New York: New York State School of Industrial and Labor Relations, Cornell University, 1967.

Etzioni, Amitai. *A Comparative Analysis of Complex Organizations.* New York: The Free Press, 1961.

Evans, Seymour. "Teacher Militancy: The Responsibility of Power." *ISR Journal,* Spring 1969, pp. 127-132.

Flexner, Abraham. "Is Social Work a Profession?" *School and Society,* June 1915, pp. 901-911.

Frankel, Charles. *Education and the Barricades.* New York: W. W. Norton and Co., 1968.

Frankie, Richard J., and Howe, Ray A. "Faculty Power in the Community College." *Theory into Practice,* April 1968, pp. 83-88.

Garbarino, Joseph. "Professional Negotiations in Education." *Industrial Relations,* February 1968, pp. 93-106.

Gittell, Marilyn. "Community Control of Education." In *Urban Riots: Violence and Social Change; Proceedings of the Academy of Political Science,* vol. 29, no. 1 (1968), pp. 60-72.

Gittell, Marilyn. "Teacher Power and Its Implications for Urban Education." *Theory into Practice,* April 1968, pp. 80-82.

Goodwin, Harold I., and Carlton, Patrick, eds. *Above the Salt: Militancy in Education.* Morgantown, West Virginia: College of Human Resources and Education, West Virginia University, 1968.

Gordon, C. Wayne. *The Social Systems of the High School.* Glencoe, Illinois: The Free Press, 1957.

Goss, Mary E. W. "Patterns of Bureaucracy among Hospital Staff Physicians." In *The Hospital in Modern Society,* edited by E. Freedson. New York: The Free Press, 1963.

Gouldner, Alvin W. "Organizational Analysis." In *Sociology Today.* New York: Basic Books, Inc., 1959.

Green, Thomas F. "Schools and Communities: A Look Forward." *Harvard Educational Review,* Spring 1969, pp. 221-252.

Griffiths, Daniel E. "Viable Alternatives to the Status Quo." In *Struggle for Power in Education,* edited by Frank W. Lutz and Joseph Azzarelle. New York: The Center for Applied Research in Education, Inc., 1966.

Harris, Louis. "What People Think about Their High Schools, the *Life* Poll." *Life,* 16 May 1969, pp. 22-39.

Kleingartner, Archie. *Professionalism and Salaried Worker Organizations.* Madison, Wisconsin: Industrial Relations Research Institute, University of Wisconsin, 1967.

Knapp, Henry. "A Tribute to the 'Real' Fathers." *Phi Delta Kappan,* June 1968, pp. 575-577.

Kratzmann, Arthur. "The Alberta Teachers Association: A Vision Vindicated." *Phi Delta Kappan,* March 1964, pp. 288-292.

Lane, Willard; Corwin, Ronald; and Monahan, William. *Foundations of Educational Administration.* New York: The Macmillan Co., 1967.

Lieberman, Myron. *Education as a Profession.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1956.

Lieberman, Myron. *The Future of Public Education.* Chicago: University of Chicago Press, 1960.

Lieberman, Myron, and Moskow, Michael. *Collective Negotiations for Teachers; An Approach to School Administration.* Chicago: Rand McNally, 1966.

Madden, George. "A Theoretical Basis for Differentiating Forms of Collective Bargaining." *Educational Administration Quarterly,* Spring 1969, pp. 76-90.

Maas, John M. "A Study of the Relationships between Specified Characteristics of Teachers and Their Perceptions of Job Satisfaction and Job Dissatisfaction Factors." Ph.D. dissertation, University of Minnesota, 1968.

Mayer, Martin. *The Teachers Strike: New York, 1963.* New York: Harper and Row, 1969.

Miller, William C. "Curricular Implications of Negotiation." *Educational Leadership* 23 (April 1966): 533-536.

Moeller, Gerald. "Bureaucracy and Teachers' Sense of Power." *Administrator's Notebook,* November 1962, pp. 1-4.

Musgrove, Frank, and Taylor, Philip H. *Society and the Teacher's Role.* London: Routledge & Kegan Paul, Ltd., 1969.

National Education Association, Committee on Educational Finance. *Financial Status of the Public Schools, 1969.* Washington, D.C.: National Education Association, 1969.

National Education Association. *Research Bulletin,* vol. 43, no. 3 (1965), pp. 69-70.

National Education Association. *Research Bulletin,* vol. 46, no. 4 (1968), pp. 113-116.

National Education Association. "Teacher Strikes and Work Stoppages, January 1940 to July 1968." *Research Memo.* Washington, D.C.: November 1968.

Nigro, Felix A. "The Implications for Public Administration." Symposium on Collective Negotiations in the Public Service. *Public Administration Review,* March-April 1968, pp. 137-147.

Paton, J. M. "Trade Union or Professional Association? The Canadian Experience." *Phi Delta Kappan,* June 1968, p. 563.

Posey, Rollin B. "The New Militancy of Public Employees." *Public Administration Review,* March-April 1968, pp. 111-117.

Rabinowitz, Frank, and Crawford, Kay E. "A Study of Teachers' Careers." *The School Review,* Winter 1960, pp. 377-399.

Rosenthal, Alan. *Pedagogues and Power: Teacher Groups in School Politics.* Syracuse, New York: Syracuse University Press, 1969.

Smythe, Cyrus F. *Introduction to Teacher-Administrator-School Board Relationships*. Minneapolis, Minnesota: University of Minnesota, 1967.

Stinnett, T. M. *Professional Problems of Teachers*. New York: The Macmillan Co., 1968.

Stinnett, T. M. *Turmoil in Teaching: A History of the Organizational Struggle for America's Teachers*. New York: The Macmillan Co., 1968.

Strom, David W. "Analysis of Trends in Power Relationships between Boards of Education and Teacher Organizations." Ph.D. dissertation, Wayne State University, 1967.

Thompson, Victor A. "Bureaucracy and Innovations." *Administrative Science Quarterly*, June 1965, pp. 1-20.

Tobiason, John R. "The Measurement of Teacher Dissatisfaction." Ph.D. dissertation, University of Washington, 1967.

Walton, Richard E., and McKersie, Robert B. *A Behavioral Theory of Labor Negotiations*. New York: McGraw-Hill Book Co., 1965.

Wildman, Wesley A. "What Prompts Greater Teacher Militancy?" *The American School Board Journal*, March 1967, pp. 27-32.

Wildman, Wesley A., and Perry, Charles R. "Group Conflict and School Organization." *Phi Delta Kappan*, January 1966, pp. 244-251.

Woodring, Paul. "On the Causes of Teacher Discontent." Educational Supplement, *Saturday Review*, 21 October 1967, pp. 61-62.

Zeigler, Harmon. *The Political Life of American Teachers*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967.

Zeluck, Stephen. "The UFT Strike: Will It Destroy the AFT." *Phi Delta Kappan*, January 1969, pp. 250-254.

Part III

System Approaches to Education: Discussion and Attempted Integration

Roger A. Kaufman

15

Introduction

WHEN reviewing the literature on System Approaches to education, I am tempted to hypothesize that the writers are determined to bring chaos out of order. Terms, phrases, and jargon abound proclaiming either new hope for valid innovation in education or dire consequences for the unwary consumer. It is my hypothesis that, when all the pieces are sorted and ordered, system thinking and system processes will be of great benefit to learners.

Because of the size of the literature in this field, I will only refer to a sample array of system literature in education and in some closely related fields. Further, although there are many applications of system models and system concepts in education, these practical applications will not be discussed in detail. This omission is not a denial of practical application or its importance, but rather is due to my arbitrary decision to conceptualize pragmatic system techniques in a way that hopefully will allow educators to better understand how the techniques might be used. I also have made no attempt either to build or to replace existing theory. Instead, I will generally discuss current practices in educational

system applications and will try to put these applications in perspective.

The chapters of this paper, when taken together, are intended to provide the educational administrator with enough information to determine the utility of a System Approach in meeting the needs of his students. A number of system tools and resources that can be profitably used by the school administrator will be identified.

I will attempt to answer the following questions:

What is a system?
What is a System Approach to education?
Where did System Approaches come from?
What are the variations available to educators today?
Are these different approaches really different?
What advantage is there to using the various System Approaches to education?
What are the tools for a generally useful System Approach to education?
What is the relationship between a System Approach and such currently discussed tools or approaches as needs assessment, behavioral objectives, system analysis, planning-programming-budgeting systems (PPBS), methods-means selection, network-based management tools, and testing and evaluation?
What objections are there to System Approaches to education, and are they valid?
What is the future of System Approaches to education?
What should a person do to obtain more information or to start a System Approach?

This paper is not intended to be the last word in educational system thinking and outcomes, nor is it designed to provide operational skills in system analysis and educational system design. There is, however, an attempt to eliminate much of the "heat" that many authors generate while attempting to provide "light." System practitioners in education are asked to excuse the limitations of this document and are invited to supplement, correct, and improve it as a possible contribution to the quantitative improvement of educational outcomes.

The ultimate utility of a System Approach is determinable only by the professional educator; it is hoped that this presentation will help him in seeking the measurable improvement of education through relevance and practicality.

16

Why a System Approach?

THE concept of change surrounds us these days, and much in education has been written about it. Change is inevitable; the question educators must face is whether we will help to shape it as participants or whether we will be swept along with it as spectators.

Many educational systems are being subjected to change—from without as well as from within. Education codes are growing bulkier; special legislation is adding to the things that educators can and cannot do; pressure groups continue to make special demands on educators; and student rebellions and teacher militancy are already routine scenery on the educational landscape.

Besides these problems of change and upheaval, there is confusion within the educational system about its goals, purposes, and methods. The educator is offered many "solutions," but few persons offering these solutions want to document their utility relative to the problems at hand. Although both educational problems and solutions abound, there seems to be little systematic, organized, and logical effort to relate the one

to the other. Yet the need for relevant educational change and reform persists.

Educators have two choices when responding to the need for change: They can *act* or *react* (cf. Johnson 1967).

Reaction is initially the easier course, for the educator can wait and then act only when a crisis occurs. Reaction is also the "safer" choice because no advance commitment is required. In a reaction mode decisions are made only when forced by mounting pressure, or when someone other than the educational administrator assumes responsibility for them.

Reaction occurred when Sputnik I was launched; lay people insisted on a bolstering of science and math in the schools, and this pressure resulted in these subjects being given top priority. Today each school agency receives similar pressures. These pressures usually center on single content areas such as reading, mathematics, or cultural studies, each of which is regarded as if it were the only really criticial area for attention.

The reaction mode in response to required change is altogether too prevalent in education. This is so, perhaps, because *specific* educational needs and measurable goals are not usually part of the educational leader's mode of operation; thus most programs are difficult to substantiate on any basis other than emotional appeal. Unfortunately, the pressure group leaders also have emotional appeal, and in the resulting contest of biases the educator is often the loser.

Action, on the other hand, is fraught with difficulties. It requires that needs be empirically determined and documented and that programs be designed that respond to the identified needs. Action requires planning, design, and evaluation skills not ordinarily found in most school agencies. Effective action depends on valid data and on the abilities to predict and to modify, based on real-world requirements.

Action—if it follows an orderly and systematic process such as a System Approach—is a logical rather than an emotional approach. As such it is frequently quite difficult to "sell" to educators and laymen who tend to operate on an emotional level.

Think of the educator twenty or so years ago who advocated racial integration of the schools and taught the responsibilities of sex to students under twenty-one! He was criticized by peer and foe alike, and had to be resolute to persevere. Other professions also have experienced this type of resistance: Remember Aristotle, or the first physician who suggested that operating rooms should be germ free. Yet progress has been made by those who determined needs, set a course for meeting these

needs, and withstood the onslaughts armed only with their belief in the data and in the validity of their goals.

A System Approach is action oriented. It starts with needs and responds to them in a logical, orderly manner. It requires that something be done and, when done, evaluated. Action is best when the goals are valid and when detailed, open, and observable planning has taken place. (This planning portion of a System Approach is frequently termed "system analysis.")

A System Approach is also action oriented in that accountability is an important ingredient in the mix; planning and action are accomplished in such a manner that others can revise the design and hopefully suggest and implement constructive improvements. Moreover, it requires initiative and commitment. The person using a System Approach must be ready to "stand up and be counted"—to document and make public exactly what he is doing, why he is doing it, and how he is doing it. Finally, the user must evaluate his efforts so that they may be continually improved. (In contrast, reaction tends to displace the "what," "why," and "how" onto someone else, thus shifting accountability to persons other than the professional educator.)

A System Approach is *not* dehumanizing, limiting, or narrowing. Because it takes into account distinct differences among people and among alternative goals, it is uniquely human and humane. It is broad and inclusive by design. Only people can dehumanize the educational process and its products, and they do not need a System Approach to do it. If essential elements are omitted from the educational system design, it is because people left them out.

A System Approach requires that education be related to documented needs and that goals and objectives be formulated to meet these needs. It requires that alternatives be considered and that results be evaluated to determine what should continue and what should be redesigned or eliminated.

For now, one definition of *system* is given (some others will be considered later):

> The sum total of parts working independently and together to achieve a required outcome.

A *System Approach* may be defined as:

> A process for effectively and efficiently achieving a required outcome based on documented needs.

As we will see later in greater detail, a System Approach is closely related to logical problem-solving.

Note that these two definitions contained no reference to computers, hardware, or gadgets. A System Approach to education is nothing more or less than the application of formal problem-solving tools and techniques to the identification and solution of priority educational needs and problems.

It is important to note that any System Approach is a *process*—a way of achieving something. Frequently, educators do not distinguish between *product* (or outcomes) and *process* (or method). Product is the end-point of something; process is the way the product is achieved. Teaching is a process, programmed instruction is a process, team teaching is a process, differentiated staffing is a process, a System Approach is a process. An educational product might be the demonstrated skills, knowledge, and attitudes of learners when they legally depart our educational agencies. The logical way to select a process is on the basis of the outcomes that must be produced.

A closer look at this process called a System Approach can be obtained by examining first some of its historical origins and then some current formulations of the concept.

Historical Roots of the System Approach

At educational meetings where a System Approach is being presented for the first time, it is not uncommon to hear the speaker begin, "With the beginning of World War II and the advent of new and complex weapons systems, this 'Systems' Approach was developed to. . . ." Although it is true that system thinking and techniques were brought to the forefront of applied science and technology during World War II, there are also a number of other antecedents to the system tools and approaches available to educators today. Much of the current system technology can be traced to work accomplished in the physical sciences, applied sciences, philosophy, and behavioral sciences. A few of these earlier system applications are outlined briefly as follows:

PHILOSOPHY

More than a few years ago, man, when thinking about himself and his environment, concerned himself with knowledge. He identified several alternative ways of acquiring knowledge, including intuition, phenomenology, rationalism, and empiricism. Of particular interest to system thinking is empiricism—the acquisition of knowledge gained from experience, especially from controlled experience. Later a scientific method

evolved for acquiring information; it was fairly reliable and allowed reasonable predictions about future events. It is this same knowledge-acquisition process that has served some system thinkers in education. By this process an educational system or subsystem can be empirically built to achieve its expressed goals. This scientific process is often termed "logical problem-solving."

PHYSICAL SCIENCES

The physical sciences have a distinguished record for providing basic information relative to man and his environment. It seems fair to say that they draw on the philosophical tool of the scientific method for their many findings, which have contributed to health, medicine, communications, space explorations, and general human well-being.

APPLIED SCIENCES

Many professional people apply basic scientific findings to specific, real-world problems. A list of applied sciences might include such disciplines as engineering, architecture, medicine, applied psychology, sociology, and economics. Some persons might add management and even education to this list. The applied sciences are characterized by the identification of problems and the application of scientific tools and processes to their resolution. Man in space, for instance, has faced and solved many problems with data provided by basic research in the physical sciences, life sciences, and mathematics. It is for the "keeper" of useful tools of technology to apply fundamental information in a way that allows for the identification and resolution of priority problems. The basic tool used here is also the scientific method, the process for empirically identifying and resolving a problem.

HISTORICAL APPLICATIONS

Just as the scientific method has proved useful in basic and applied sciences, it also has been applied successfully to education. Before examining the history of these applications in education, I will cite a few examples of how this process called the scientific method or logical problem-solving has been applied to some other disciplines. Thus the lineage of system concepts applicable to education today can be more easily identified.

SYSTEM ENGINEERING AND SYSTEM MANAGEMENT

In military system development, procedures have been used that are based on empirical development of vehicles for achieving required outcomes. The system engineering process basically uses a six-step pro-

cedure: (1) problem identification, (2) specification of detailed goals and subgoals, (3) identification and selection of alternatives for achieving the goals and subgoals, (4) design and utilization, (5) evaluation, and (6) required revision (Corrigan and Kaufman 1966 and USAF System Command 1965).

System engineering and system management techniques began during World War II and are still being developed (Cook 1966, 1967, and 1968; USAF System Command 1965 and 1968; U.S. Department of Defense 1967; and U.S. Government 1968). Each has as its goal the improved effectiveness and efficiency of the problem-solving process. The techniques, with their associated tools and procedures, have been most widely applied to development of weapon systems. They have been used by government contractors and commercial engineering agencies.

COMMUNICATION THEORY

Physical scientists, mathematicians, and behavioral scientists working in communications became concerned with the measurable improvement of message transmission and reception. Human communication and information models were developed, including Shannon and Weaver's Information Theory (1949), which provided a tool for measuring the relationship between a message sent and received. These formulations provided the conceptual tools, models, and mathematics for relating a system's inputs to outputs.

Several concepts in current system work in education can be traced back to the earlier communication theory. These concepts include (but are not limited to) the references to inputs and outputs; the notion of a system as a set of interrelating components designed to achieve an outcome; the inclination to measure interactions between people on a verbal basis; and the notion that information and its handling can be systematized, predicted, and measured.

THE DIGITAL COMPUTER

The digital computer plays a critical role in education system thinking. Because of its rapid calculation ability, long and complex problems may be handled with relative ease. Misnomers such as "thinking machines" and "electronic brains" have communicated extensions of human abilities to some and fear of dehumanization to others. To make use of the computer's great capabilities, programmers have designed "systems" for improving the efficiency of many operations currently required in business, military, and education. Because of its reliability and integrity, the computer is seen by some educators as having applications to learning (cf.

Atkinson 1968 and Gerard 1967), as well as to housekeeping and administration.

(For better or worse, the hardware for computing, the systematization process, the development of efficient procedures, and the tools for making things more efficient all began to be referred to as "systems." This (mis)use of the term is perhaps the cause of some of the current confusion concerning the applications of system concepts and system-design procedures to education. More will be said about these semantic difficulties in a later chapter.)

HUMAN FACTORS ENGINEERING

Human-factors scientists in industry and the military studied large systems, usually (but not exclusively) weapon systems, where people and equipment had to interact successfully to achieve overall system requirements (cf. Morgan et al. 1963). To design equipment that people could use effectively, the concept of a *personnel subsystem* was evolved. It identified human beings, with their distinctly human and nonlinear and often unpredictable characteristics, as one interacting element in an overall system. The concept required that the planning and design of any system include people, and, further, include them in such a way as to assure that the total system achieved its goal. Useful tools were created, including task analysis—a procedure for identifying skills and knowledge required of people to achieve an overall goal (cf. Miller 1954).

SCIENTIFIC MANAGEMENT

The economist, the industrial manager, and the political scientist were also progressing along a "system" line (cf. Cleland and King 1968, Cleland and King 1969, and Etzioni 1964). Economists were building models of economic men, models of economies, and models for predicting human behavior in a world of goods and services. The industrial manager embraced scientific methods in seeking means to improve the effectiveness and efficiency of business organizations without manipulation of people. The old concept of people exploitation, so long a standard in business, was giving way to people-oriented management. The political scientist worked with models and other scientific tools to help predict and explain the behavior of large groups of people.

LEARNING SCIENCES

Behavioral scientists were adopting approaches and tools that, again for better or worse, came to be termed "systems." Skinner (cf. Holland and Skinner 1961) developed a method of teaching based on operant

conditioning. Students responded and learned by a method that came to be known, among other labels, as linear programming. Alternative schemes ("systems") were developed by other researchers; Crowder, for example, devised a teaching method called "intrinsic" or "branching" programming.

Under the rubric of "programmed instruction," the teaching-learning process received close attention, and learning began to be perceived as an empirical phenomenon—either it occurred or it did not. Quantification, evaluation, and some occasional research went into the design of learning "systems" where the goal was the measurable improvement of learning. The process applied to much of the development of programmed instructional materials was quite similar to the philosophical tool called the scientific method.

COST-BENEFIT ANALYSIS

In some areas relatively remote from education, tools and procedures have been developed that have or will have an impact on education. In response to the increasing concern of government with the costs and benefits of programs (cf. Smithies 1969), applied scientists, technologists, and accountants began to consider effectiveness in relation to cost, or the relationship between resources and required outcomes. Tools such as cost-benefit analysis and planning-programming-budgeting system (PPBS) were seen as useful and were elaborated to enable system developers to identify and decide among alternative methods and strategies for achieving required goals (cf. Cleland and King 1968 and 1969, Fisher 1969, Holtz 1969, Lynn 1969, Morrison 1969, Quade 1969, and Rath 1968). Again, for better or worse, these tools became known as "Systems" Approaches, perhaps because they considered the interrelationships of numerous variables in the achievement of a required product.

GENERAL SYSTEM THEORY

General System Theory evolved from a desire by a few integrative thinkers to "establish principles applicable to entities not covered in conventional science" (Von Bertalanffy 1968). Its function is to integrate and explain the phenomena and relationships that occur in any system, be it a human organism or the buildup of frost in refrigerators. It attempts to describe various systems and to find relationships among them. If nothing else, General System Theory (sometimes called General Systems Theory [Buckley 1968]) has shown scientists and implementers the necessity of considering all the interacting variables that form a given phenomenon.

All the applied scientists working with a system concept seemed to have some things in common. They all emphasized the critical role of people in planning and design. They all tended to use scientific methodology and to show a respect for the importance of using careful, controlled procedures in obtaining and using information. Finally, they all tended to develop "systems," i.e., procedures and processes for achieving results.

The Development of System Concepts in Education

At a time when some are saying that education is failing (or has failed), others are trying to make education responsive to the student and his world. Researchers have been experimenting with such educational innovations as team teaching, programmed instruction, differentiated staffing, needs assessment, behavioral objectives, network-based management tools, and assessment and evaluation techniques. Borrowing tools from other disciplines and also inventing its own, education has been adopting and adapting that which is useful.

Education is the intersection of our culture; it is where we teach our young about the world formed by ourselves and hopefully provide them with some skills for its improvement. It is the compilation of almost everything in our culture, good, bad, and indifferent.

Although slow to change (Brickell 1961), education will improve, but perhaps only on the arrival of a systematic, orderly, self-correcting process that allows it to identify its needs and to design a responsive system for meeting the needs.

It is difficult to determine when system concepts first began to appear directly within an educational context. Charters made one of the first entries in 1954 with "Is There a Field of Educational Engineering?" In it he related educational endeavors and engineering processes. At the Second Lake Okboji Audio-Visual Conference in 1956, Hoban proposed an instructional Systems Approach to audiovisual communication. In 1960, Carpenter suggested a general strategy for a man-machine Systems Approach to the solution of complex educational problems.

In plotting the course of system concepts in education, it is interesting to note that the educational journal *AV Communication Review* has been a rich source of system thinking and system concepts, perhaps starting with Finn's "Technology and the Instructional Process" (1960). Also included are Bern's "Audiovisual Engineers" (1961), VanderMeer's "Systems Analysis and Media—A Perspective" (1964), Barson and Heinich's "A Systems Approach" (1966), and more recently Kaufman's "A System Approach to Education—Derivation and Definition" (1968).

Silvern made many early contributions to system thinking in education, but his formal publications did not begin receiving wide attention until the availability of "Fundamentals of Teaching Machine and Programmed Learning Systems" (1964), "Guide to Basic Analysis" (1964), and "Studies in the Systems Engineering of Education," part of a series that began in 1965.

A major source of information on system concepts and their application to education is Ofiesh and Meierhenry's *Trends in Programmed Instruction* (1964), including articles by Corrigan, Morrill, and Kaufman. In 1962, Kaufman brought system thinking to the attention of junior high school educators in a conference paper entitled, "The System Approach, Programmed Instruction and the Future."

Also of importance is Operation PEP, a major program funded by Title III of the Elementary and Secondary Education Act of 1965 to provide senior educational planners in county and district education offices in California with skills in system analysis and system management. Many unpublished materials by Corrigan were used in this program. In 1966 and 1967 Corrigan and Kaufman prepared for Operation PEP many materials dealing with detailed, yet preliminary, formulations of system analysis and system synthesis applications to education.

Two other landmark programs in educational system technology were funded under the Experienced Teacher Fellowship Program (Higher Education Act of 1965) at Syracuse University and Chapman College.

Additional works are becoming available. Mager (1961) has written a number of books on vocational training and "affective domain" considerations in educational design. Banathy, in *Instructional Systems* (1968), provided a guide for applying system methods to instructional design. Corrigan, in *A System Approach for Education (SAFE)* (1969), developed a general education model and presented tools for educational system design and implementation.

Education thus has received valuable contributions from many sources. Philosophers have provided a logical problem-solving strategem; applied scientists have devised detailed schemes and processes for achieving results (perhaps the engineering of education); behavioral scientists have developed strategies and tools to improve the teaching-learning process; general system theorists have provided concepts and descriptive tools by which general properties of one system can be identified and compared with those of another; and educators are attempting to improve learning outcomes with the help of educational agencies.

What better time for valid innovation? What better time for the appli-

cation of proved techniques and technology? What better time to identify our needs, determine requirements for meeting these needs, select alternative tools for meeting the needs, implement these tools, evaluate them, and constantly revise them to insure relevance and practicality in education?

One tool for improving education is a System Approach. In the next chapter I will examine the process of education—a process of learning management—in an attempt to determine what an educational management system is and why a System Approach can be usefully applied to it.

17

Education and Management: Design-Process Mode of a System Approach

WHAT is it that educators do? "Provide instruction (teach)," "provide facilities and equipment," and "provide learning resources," are among the usual answers. I submit that the main task of education is *learning management*, and that the planning, organizing, designing, implementing, evaluating, and revising of learning opportunities and vehicles form the basic dimensions of providing relevant and practical learning experiences. This is what educators should do.

This view implies that the management process involves the identification and control of many subsystems (or parts) that, when combined, will achieve required learning outcomes. The way the salient variables and required resources are identified and used becomes the critical question for achieving relevant and practical learning outcomes.

The central question for educators, and especially educational administrators, therefore, is *what must be done*. Then, the determination of *how to do it* becomes of interest in a proper sequence. Many educational ills come from entering the educational management situation with a solution (or a how-to-do-it) before the needs have been determined.

Relevant and practical educational management begins, therefore, with the determination of educational needs. It progresses to the selection of required "hows," to the development and implementation of the "hows," and finally to the evaluation and revision of the total process. This is a basic model for educational management that has been termed "A System Approach to Education" (Corrigan 1969, Kaufman 1968, and Kaufman and Corrigan 1967).

A *system* thus conceived may be defined as the sum total of parts working independently and in interaction to achieve previously specified outcomes. (Some other definitions of "system" will be examined soon, for they give clues as to possible tools and strategies for efficient and effective management.)

First, let us settle on a definition of "management." There are more than a few. Cook (*Overview* 1968), for example, identifies two overall management functions: a planning subsystem and a control subsystem. The planning subsystem is broken down into project-definition subsystem, work-flow subsystem, time-estimation subsystem, scheduling-resource-allocation subsystem, and cost-budget subsystem. The control subsystem is divided into a report subsystem, action and decision subsystem, and an implementation or recycling subsystem. Cook's formulation has the advantage of indicating that a hierarchy of functions and subfunctions is required for project management. Also, these functions are interrelated and do not form a "laundry list" of linear functions to be performed. MacDonald (1969) indicates that a management process to reach a predetermined objective would include five parts: planning, organization, staffing, direction, and control.

Both Cook's and MacDonald's models afford the insight that management is a controlled, orderly, and self-correcting activity directed toward the achievement of specific, required outcomes. Both assume, however, that the objectives of the project or activity have been identified, quantified, and are in fact valid. This assumption may be fanciful for many current educational undertakings. An educational activity may be managed with precision and accuracy; but if its objectives are not valid, the result may be educational ruin arrived at in an orderly, precise, and efficient manner.

The first duty of a professional *educational manager* (or administrator, for those who prefer that handle) is to see that the management process begins only after the validity of the program objectives are verified or reverified.

Responsive Educational Management Starts with an Assessment of Needs

If we were to accept the definition of a "need" as the discrepancy between *what is* and *what should be* (Kaufman 1968), then we have a possible starting point for an assessment of educational needs. It is important that a project or educational program not be started with just any perception of needs. Rather, the identified needs should be the actual needs found in the real world, for this is a key to relevance.

Many educational projects claim to be systematic approaches simply because their objectives are stated in precise, measurable terms, such as those suggested by Mager (1961). Objectives may be quite measurable and precise *while* being trivial or even wrong! Objectives must not only be measurable, but meaningful as well.

Kaufman, Corrigan, and Johnson (1969) propose a model for quantifying one of the most salient variables in needs assessment—educational utility. The model suggests that learners, on legal exit from an educational agency, should have sufficient skills, knowledge, and attitudes to be able to survive in the real world at least at the level where consumption equals production. The authors further suggest that Hanna's (1966) three foci of curriculum could be used to derive a needs assessment procedure whereby the discrepancies between *what is* and *what should be* can be calculated according to the dimensions of (1) the nature of society, (2) the nature of learner, and (3) the nature of knowledge. Further work with this model might well include a fourth variable—the nature of the educator who is to implement the change process.

If the achievement of relevance in education is of prime importance, then the vehicle(s) for determining relevance should be paramount in any educational management model. In summary, to insure relevance, an educational management process should either include or proceed from a valid needs assessment that consists of problem identification and selection (Kaufman and Harsh 1969 and Sweigert 1969).

Problem Solving—A Description of a Management Process

The educational manager must attempt to meet the needs of society, of learners, and of fellow educators. As a suggested means of helping him in this task, a *design-process* mode of a System Approach will be described in some detail. This process is a problem-solving approach and is suggested as a generic (or general) model for educational management.

From needs, problems are identified. For the purposes of this discussion, a *problem* is defined as the requirement to *reduce or eliminate* a discrepancy between what is and what is required. Thus *needs* are identified as discrepancies, and *problems* are derived from the identified needs. An example of a hypothetical need in education might be: "Children in state X have a mean reading score of Q on valid test Y, which is F% below mandated performance." A problem that could be derived from this hypothetical need might be: "To raise the children's reading skill level so that their mean reading score on valid test Y will be at or beyond the required level on or before time T."

Needs can be identified through a process previously called "needs assessment." All needs relative to a given area (such as within a specified school district or a community) can be identified through this process, and priorities can be placed among them. Needs assessment increases the probability of identifying valid needs and, from them, relevant problems.

By the above definition, a problem has both a beginning and an end. The beginning is what presently exists and the end is what the conditions will be when the problem is solved. Problem solving is a process by which one attempts to get from what is to what is required. The most effective and efficient strategy for problem solving might be called "logical problem solving."

It was stated that the design-process mode of a System Approach is a form of logical problem-solving (Corrigan and Kaufman 1967 and Lehmann 1968) akin to the scientific method. Kaufman (1968) has demonstrated this problem-solving model by applying it in a simple step-by-step procedure to the solution of a mathematics problem: $X + 1 = 10$. The following is a simplified example of how this or more complex problems can be approached and solved by use of the problem-solving model.

Step 1: Identify and define "what is." In this example, $X + 1 = 10$, we define our starting conditions and assumptions. First, we assume a number system to the base 10. Second, we assume that a person solving the problem knows the rules of working in that number system. All assumptions and starting conditions are to be identified and defined.

Step 2: Identify and define "what is required." The criteria for acceptable problem solution are identified and defined in operational or measurable terms. For example, the correct solution will be achieved when the equation is symmetric ($X + 1 = 10$ and $10 = X + 1$).

FIGURE 1

APPLICATION OF GENERIC PROBLEM-SOLVING MODEL TO A SIMPLE PROBLEM

Step Number	*Explanation*
1. Identify and define "what is" or current condition	$X+1=10$
2. Identify and define "what is required"	Determine "X" such that $X+1=10$ and $10=X+1$
3. Identify and select process steps for getting from step 1 to step 2	(a) subtract 1 from each side (b) guess (c) look on someone's paper (d) etc.
4. Implement selected solution strategy	$X+1=10$ $X+1-1=10-1$ $X=9$
5. Determine validity of outcome	Let $X=9$, then $X+1=10$ because $9+1=10, 10=10$, therefore $9+1=10$ and $10=9+1$
6. Redo if necessary	If we had selected an incorrect strategy and arrived at, say, $X=5$, then in checking we would have arrived at $5+1\neq 10$, so redoing of all or part of the process would be required.

Step 3: Select process steps for getting from step 1 to step 2. Eldridge, in *Maxims for a Modern Man* (1965), states that "wisdom is the ability to discover alternatives." In this step, then, the best procedure for solving the problem is selected from among identified alternatives. Alternatives might include (1) count on fingers or count physical objects, (2) guess, (3) ask the teacher or look on someone else's paper, (4) keep substituting numbers for X, (5) count mentally to derive answer, and (6) use mathematical logic. System practitioners frequently use cost-effectiveness or cost-benefit as the criterion for selecting solution strategies.

Step 4: Implement process. The selected process (or methods-means) is implemented and the product obtained.

Step 5: Determine validity of outcome. The outcome or product is analyzed to determine the extent to which it meets the criteria in step 2.

Step 6: Redo if necessary. This final step of self-correction allows redoing or modifying any or all steps in getting from "what is" to "what is required" so that the output will reduce or eliminate the identified

need. Allowing modifications to meet requirements is a characteristic of a self-correcting or *closed-loop* problem-solving model.*

Figure 1 shows this six-step problem-solving model applied to the problem of solving the equation $X + 1 = 10$.

A System Approach to Education

The six-step model just derived is a general one; that is, it can be applied to any problem, be it $X + 1 = 10$ or the vastly more complex problems we find regularly in education. It is the basic model for a System Approach to education that can be used to identify as well as solve problems, rather than being only solution oriented or descriptive in nature (Corrigan *System* 1966, Corrigan et al. 1967, Corrigan and Johnson 1966, Kaufman 1967, Kaufman and Corrigan 1967, Kaufman et al. 1967).

The model is depicted in figure 2 in a flow chart, or more precisely, a *function-flow-block-diagram*, which is simply a diagrammatic representation of things to be done in the order in which they are to be done; functions and interrelationships are identified in a single visual format. The diagram shows the steps or process functions for going from "what is" to "what is required," and it may be read by following the order of the numbers and by following the solid lines and arrows. Each function (or step) in the problem-solving process is independent of the others, as signified by enclosure in a box. The broken lines indicate the ability to redo a previous function if necessary.†

Why use a design-process mode? Although it is obvious that problems in education are vastly more difficult than $X + 1 = 10$, this same basic model can be applied to any problem, no matter how simple or complex. By formally applying this System Approach model, we can be assured that a self-correcting strategy is being followed and that relevant and cogent variables will be considered. The formality, openness, and objectivity of the approach reduce the risk of overlooking important elements or using inappropriate solution strategies.

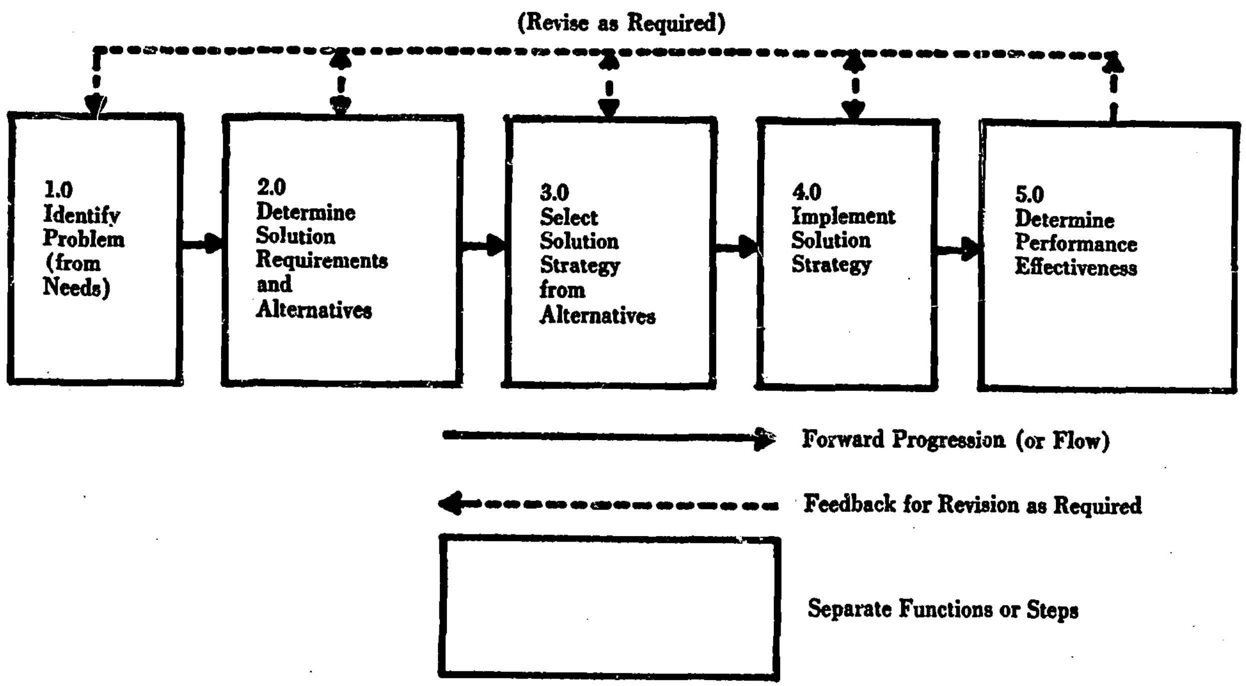
The model is a tool *for* educators; it is not mechanical and it is not dehumanizing when applied. It does minimize the likelihood of adopting prepackaged solutions before the requirements for solution have

* Note that evaluation and decision making occur at each step of the process, not only at step 5. Each step requires a product that must be achieved before the next step begins.

† Further information about this particular method of flow charting may be found in *Functional Analysis in Education*, by Kaufman et al. (1967). Another useful flow-charting procedure is offered by Silvern (*Logos* 1969).

Figure 2

Diagrammatic Representation of a Problem-Solving Process



been identified. Educational agencies often have had unfortunate experiences with the application of solutions that have turned out to be inappropriate to the problem simply because there was a leap from "what is" to the selection of the strategy before the "what is required" had been identified and defined. Perhaps the reader can think of examples of rushing to a panacea only to find out that it was a solution all right, but not to the problem at hand!

Earlier I defined a system as the sum total of separate parts working independently and in interaction to achieve previously specified objectives. Like the model of a System Approach to education in figure 2, which may be called a problem-solving "system," education also may be viewed as a system. Components of an educational system could include teaching and instruction, management and administration, facilities and support, community, and learners.

Considered separately, each of these parts also may be classified as a system. Thus a System Approach could be used to identify and solve a problem relative to any one of these individual systems by itself. Most educators realize, however, that it is artificial to think of these "systems" as independent from each other since they interact in the real world. An educational system therefore should be viewed as an integrated whole comprised of components that, when combined, become subsystems of the overall system.

Use of a System Approach to solve an educational problem would seem to insure that the complex interactions among the parts of the educational system will be properly considered. A System Approach requires that problems be solved in such a way that all the system's parts working independently and together will achieve previously specified objectives. This formal problem-solving model apparently is well suited to serving the complex educational world.

Several major assumptions of a System Approach are as follows:

1. Needs can be identified and ultimately stated in measurable terms.
2. Human beings learn, and the type of learning opportunities and stimuli provided them can determine, at least, the direction of this learning.
3. A systematic approach to educational problem solving will result in measurably greater effectiveness and efficiency than will any other approach presently available.
4. Attitudes and behaviors can be specified in measurable terms, at least by *indicating* the type of behavior required.
5. It is better to try to state the existence of something and attempt to quantify it than it is to proclaim that it is nonmeasurable and to leave its existence and accomplishment still in question.

6. There is often a difference between hope and reality.
7. Teaching does not necessarily equal learning. (The teaching act and the learning act are different.)
8. Areas of education that seem to defy quantification in system design are prime areas for research.
9. A self-correcting System Approach has greater utility than an open-loop process for achieving responsive education.
10. No system or procedure is ever *the* ultimate system. A System Approach, like any other tool, should constantly be challenged and evaluated relative to other alternatives, and should be revised or rejected when other tools are more responsive and offer greater utility.

A Brief Introduction to the Tools of a System Approach

There are several tools and techniques for implementing a design-process mode of a System Approach. These formal methods may be arbitrarily divided into two categories: *system analysis* and *system synthesis*. Expressed simply, system analysis deals primarily with the first two problem-solving steps: (1) identify problem from needs and (2) identify solution requirements and alternatives. System synthesis techniques, on the other hand, are useful for implementing steps three through six. The relationship of system analysis and system synthesis to a System Approach to education is demonstrated in figure 3.

Step two of system analysis includes the use of four basic tools for educational planning: mission analysis, function analysis, task analysis, and methods-means analysis (Corrigan et al. 1969, Kaufman and Corrigan 1967, Kaufman et al. 1967, and Wright and Furse 1969). Each of these tools is described briefly as follows:

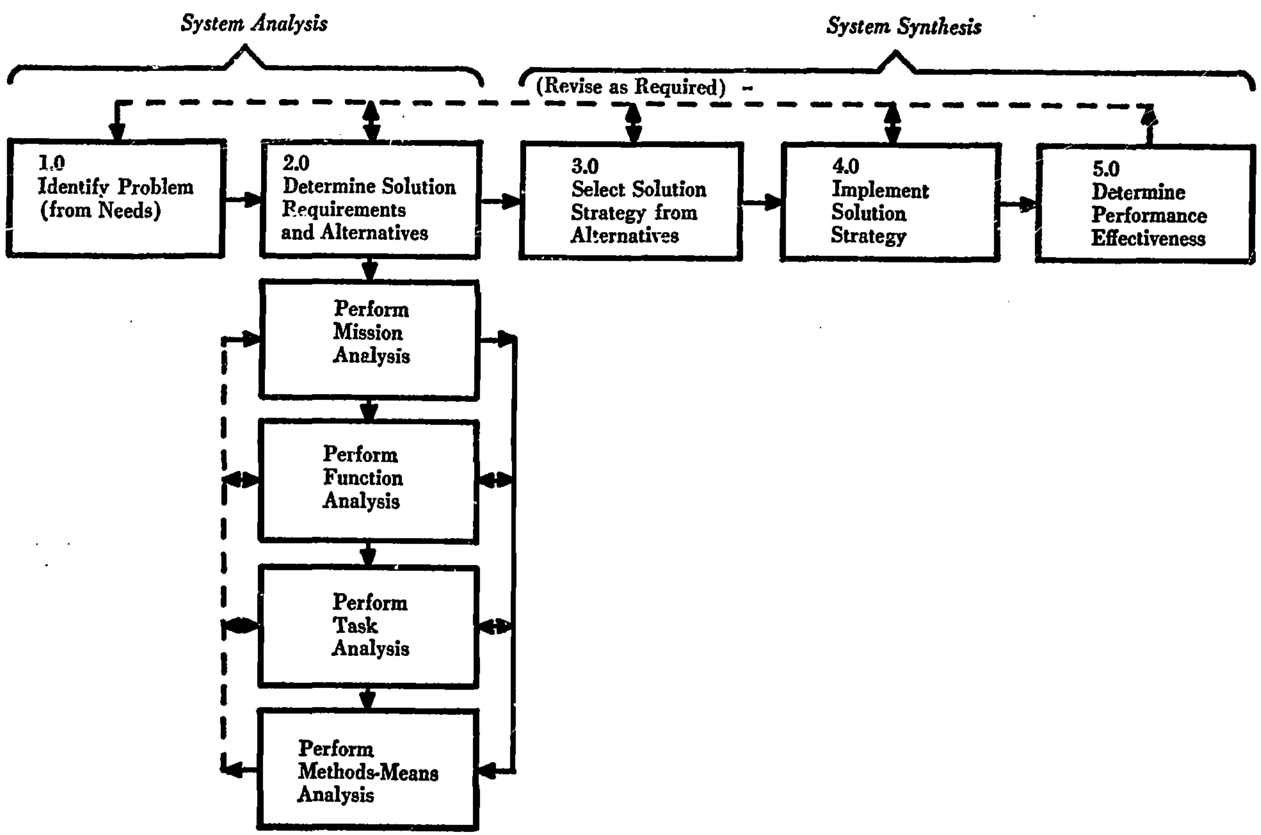
MISSION ANALYSIS

Mission analysis is a determination of where one is going and how to know when one has arrived. Recalling that a "system" was defined to include the achievement of "previously specified objectives," the first job of an analyst is to identify the elements of the problem-solving process that specify precisely what is required. Mission analysis includes the steps of identifying (1) an overall mission objective, (2) the specific, measurable performance requirements for completing the mission, and (3) a management plan called a "mission profile."

By identifying the mission objective and the performance requirements, the system analysis process continually defines the "whats" necessary for problem solution. These "whats" will then be used in system synthesis where "how" determinations are made. Since the "hows"

FIGURE 3

SYSTEM ANALYSIS AND SYSTEM SYNTHESIS RELATED TO A SYSTEM APPROACH TO EDUCATION



cannot come before the "whats," use of this System Approach virtually eliminates the possibility of solutions being introduced before the problem has been identified and defined.

The final step in mission analysis is the derivation of a management plan to identify the steps for getting from "what is" to "what is required." This central path for problem solution is called a "mission profile." An example of a mission profile for solving educational problems by means of a System Approach has already been presented in figure 2. Actually, each problem will have a different mission profile depending on the "what is" and the "what is required." Figure 4 shows a possible mission profile for preparing instructional materials by means of a System Approach. Since all functions can interact, not all "feedback" or revision pathways are identified in the figure.

Mission analysis, then, identifies what is required and derives the central path for achieving problem solution.

FUNCTION AND TASK ANALYSES

Function analysis and task analysis are closely related to mission analysis. They consist of breaking down each function identified in the mission profile into all its component functions. Function and task analyses may be viewed as vertical expansions of the mission profile, and continue until units of performance or "tasks" are identified. The differences among mission analysis, function analysis, and task analysis are differences of degree rather than of kind. Figure 5 shows a hypothetical function analysis.

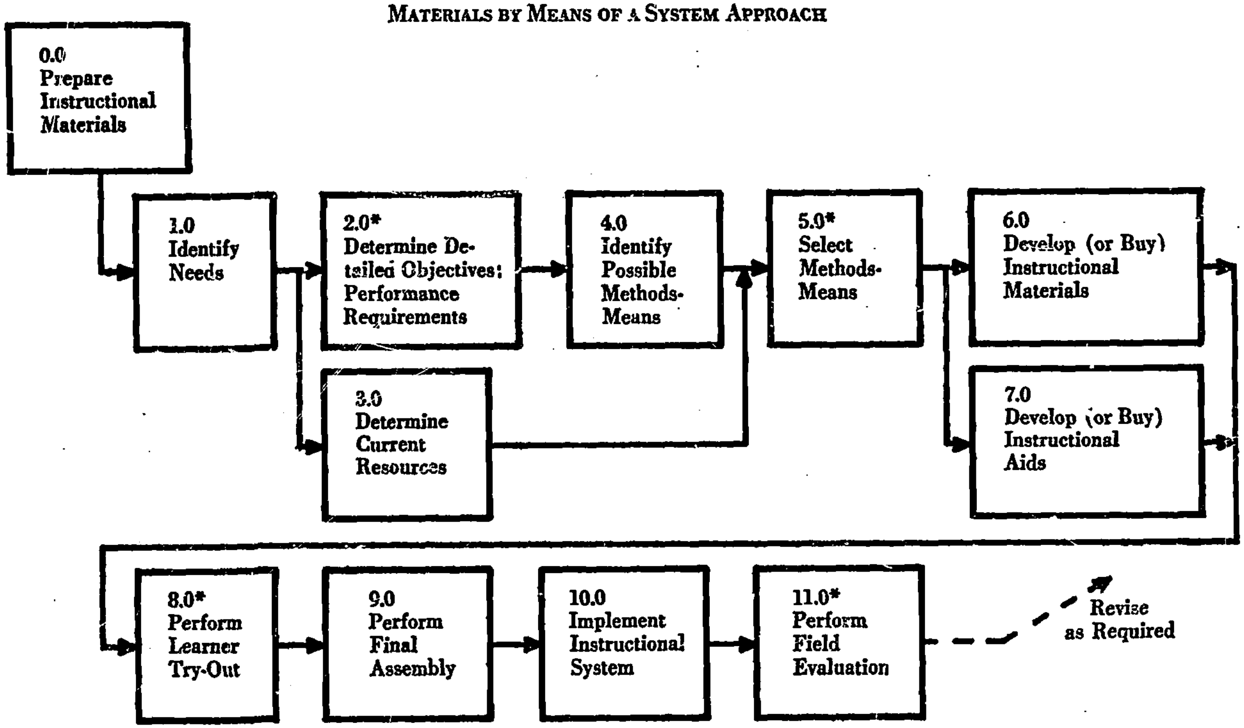
METHODS-MEANS ANALYSIS

This remaining step identifies possible strategies for accomplishing each performance requirement or family of performance requirements identified in the mission, function, and task analyses. In practice, the methods-means analysis can begin at any point in the system analysis procedure, and thus can be continually refined as more detailed performance requirements are identified. Sometimes one or more of the performance requirements cannot be achieved because the appropriate methods-means are unavailable or do not exist. This constitutes a constraint, which must be reconciled before the analysis can continue.

Next the advantages and disadvantages of each methods-means are listed. Like all the other steps in the system analysis, this one only identifies "what" is available, not actually "how" to do it. The total system analysis provides the data for selecting and implementing the most effec-

FIGURE 4

POSSIBLE MISSION PROFILE FOR PREPARING INSTRUCTIONAL MATERIALS BY MEANS OF A SYSTEM APPROACH



*Indicates possible points for obtaining approval before proceeding.

Figure 5

Example of a Hypothetical Function Analysis Showing the Manner in Which Any Function May Be Analyzed in Lower Level Constituent Functions

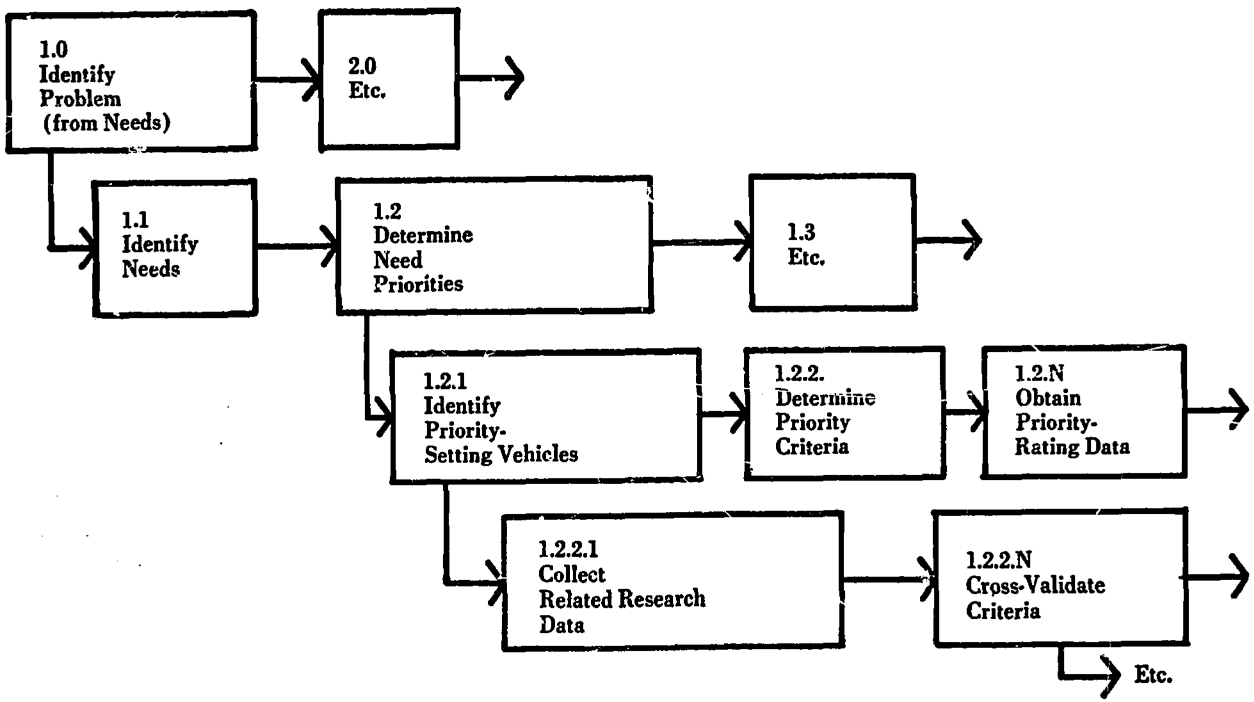
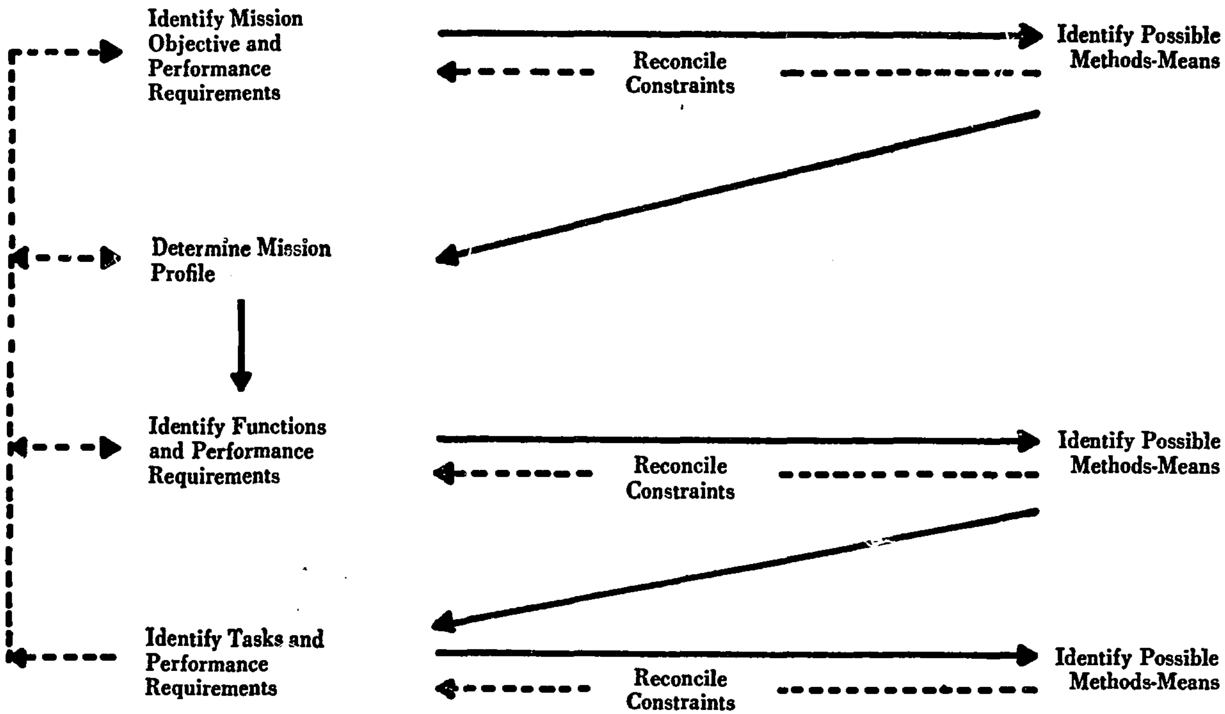


FIGURE 6

SYSTEM ANALYSIS PROCESS MODEL IDENTIFYING RELATIONSHIPS AMONG STEPS IN THE PROCESS



tive and efficient solution strategies and vehicles for getting from "what is" to "what is required."

The process for accomplishing a system analysis is shown in the process chart in figure 6. The questions to be answered by a system analysis are reviewed in figure 7.

Once the data base of feasible "whats" is obtained through system analysis, it is used in system synthesis to select solution strategies and vehicles for realizing the identified performance requirements. Generally, system synthesis consists of the following steps: select solution strategy, implement solution strategy, determine performance effectiveness, and revise and correct as required (Corrigan et al. 1967).

FIGURE 7

QUESTIONS TO BE ANSWERED IN A SYSTEM ANALYSIS AND THEIR RELATION TO THE STEPS OF PERFORMING A SYSTEM ANALYSIS

Questions To Be Answered by an Educational System Analysis	*Steps in Performing an Educational System Analysis*
Where are we going and how do we know when we've arrived?	Determine mission objectives and performance.
What are the things that will keep us from where we're going and how do we eliminate them?	Determine and reconcile constraints.
What are the major milestones along the way to where we're going?	Determine mission profile.
What are the "things" that must be done to get to each milestone?	Perform function analysis
Of what specific tasks are the "things" composed?	Perform task analysis
What are the possible ways of getting the "things" done?	Perform methods-means analysis.

SUMMARY

The relationship among a generic problem-solving model, a System Approach, and educational management has been briefly described. The six-step model was suggested to comprise a design-process mode of a System Approach for identifying and solving educational problems. Further, the steps and tools of system analysis and system synthesis have been shown to derive from the model.

The six-step model or design-process mode of a System Approach is similar to models that have been used in the physical and behavioral sciences for many years. Indeed, the process behind the model characterizes all empirical sciences. The only question that it seems to pose for education is whether or not educational outcomes and procedures can be measured in a performance context.

My position is that at least *minimal* requirements for educational outcomes must be specified in measurable performance terms. Those areas where such precision and quantification are not possible should become high priority areas for research and development so that minimal educational requirements can be identified and stated in measurable terms. It would seem to be less than rational to base an educational activity (or any other, for that matter) on outcomes that cannot be observed, measured, evaluated, and revised.

Both Cook (*Overview* 1968) and MacDonald (1969) emphasize objectives, maintaining that management must be relative to achieving some product or outcome. If this outcome is not specifiable, then management becomes tenuous and subject to question.

It seems, therefore, that the six-step management model, which requires that objectives be defined and specified, would be of use in educational management.

18

Other System Approaches

OTHER models and techniques have been proposed or are being used in education that are termed "System" or "Systems" Approaches. A review of the literature indicates that these various approaches can be roughly separated into three categories* similar to those suggested by Roshal (1968):

1. Design-process mode
2. Solution-implementation mode
3. Descriptive mode

The design-process mode has already been briefly discussed as applied to education. In other disciplines, a close analog is system engineering. The design-process mode assumes little or nothing about the validity of any system in operation; instead, it designs a new system to accomplish specified outcomes.

* Not all approaches can be accurately placed within these categories. The separation is a convenient means of describing many approaches currently used by practitioners.

Solution-Implementation Mode

The solution-implementation mode is usually concerned with the identification and use of solutions (or "systems") for dealing with complex situations. The use of computer-aided instruction, for example, involves the application of a "system" (computer-aided instruction system) to the teaching of learners in a manner supposedly more effective and efficient than previously possible. An analyst using this mode closely studies the man-machine interrelationship, and then selects or designs a solution.

Use of the mode assumes that a valid need exists and that a number of "givens" are acceptable. In the application of many computer-aided instruction systems, for example, the learning content is assumed to be viable; the only perceived need is for a more effective and efficient format to present that content to learners. Also, computer-aided learning is assumed to be in fact a "system," which, when used in the larger educational system, will become a subsystem interacting appropriately with all other subsystems.

Assumptions such as these underline the difference between the solution-implementation mode and the design-process mode. The latter seeks to demonstrate the validity of the assumptions before selecting a solution and a solution strategy. Such things as programmed instruction, computer-aided instruction, team teaching, differentiated staffing, and the like *are* solutions (or methods-means). But what problems do they go with? Can a technological procedure be useful if it is only brought to bear on the symptoms of a problem rather than on the problem itself? If the analyst is convinced that the problem being dealt with is truly the central one, then the solution-implementation mode may be a powerful tool. If some doubt exists, then other alternatives might well be considered.

It might be useful to examine a definition of *system* that seems to characterize the solution-implementation mode:

> "A combination of men and machines which makes maximum use of all resources, whether they be human or mechanical in nature" (Gibson 1968)

Note that the solution, according to this definition, stems from a man-machine relationship that is inferred by a situational requirement to maximize the interaction between people and equipment. The definition is, therefore, solution oriented.

When the problem has been identified and is based on valid needs, the educator might well elect to use the solution-implementation mode. Once the required educational outcomes are stated in measurable performance terms (such as suggested by Mager [1961], Popham [1967],

or Smith [1964]), the educator should identify methods-means selection criteria to be used in determining the appropriate strategies and tools for achieving the required outcomes. One criterion frequently used is cost-benefit. It requires that selection be made from among alternatives on the basis of "what do we give" and "what do we get." That is, if we have valid objectives and have identified possible alternative ways of achieving them, then we might select those methods and means that will achieve them at the lowest possible cost in terms of time and effort. (Notice that the quality of output is not to be compromised; minimal standards are identified and are observed in the selection.)

SYSTEM OR SYSTEMS?

Readers may have noticed the differing uses in this paper of the words "system" and "systems." It is now worthwhile to discuss the meaning behind this distinction. Cleland and King, in their text *Systems Analysis and Project Management* (1968), discuss the tools and techniques for deciding among alternatives. They use the term "systems analysis" in a different way than I have defined it. Systems analysis as defined by Cleland and King involves:

1. Systematic examination and comparison of those alternative actions which are related to the accomplishment of desired objectives
2. Comparisons of alternatives on the basis of the resource cost and the benefit associated with each alternative
3. Explicit consideration of uncertainty

The semantics are now getting a bit tricky. Cleland and King seem to be talking about the determination of the viability of alternative "systems" in order to select one or more from among alternatives. On the other hand, I reserve the singular form *system* to mean the sum total of parts working individually and together to achieve specified objectives; *system design* I refer to as the process of building "from scratch" a system; and *system analysis* I define as the determination of requirements and the identification (but not selection) of possible solutions to get from "what is" to "what should be."

"Systems" Approaches tend to look at more than one system and to determine ways of combining and integrating the systems to solve problems. The System Approach tends to design, from the beginning, a single system for meeting requirements. It emphasizes starting the system design process from *needs*, whereas most Systems Approaches tend to assume that needs are already identified and that solutions only have to be systematically selected and combined to achieve stated objectives. The differences thus might be more than semantic quibbling.

If one decides to use a solution-implementation mode, the independent "systems" might not work as "subsystems" when one tries to integrate them into the operational educational system. As an illustration, consider a high school whose students are having a problem with reading ability. Recalling my definition of a system, any educational system has overall goals, (hopefully) measurable objectives, and many subsystems for achieving these goals. The subsystems of the hypothetical high school might include learners, teachers, administrators, counselors, rooms, media, etc. The job of the school's administrator is to make these various subsystems and parts work independently and together to achieve the goals of the school.

Now let us say that the administrator has identified three alternative systems for raising the students' reading level: a media package using three screen-presentations and audio, a programmed instruction course in remedial reading, and a sensitivity training course for teachers and administrators. Which system should the administrator select? If he were to apply some of the techniques described by Cleland and King, he might perform trade-offs between the costs and benefits of the three alternatives and choose a system that hopefully would reduce or eliminate the reading deficiency. Suppose the decision was made by charting the point at which predicted minimal reading skills cross the point of funds allocated by the school district for reading and special education. Suppose further that the "best" choice according to this cost-benefit analysis is the programmed instruction course. To assure himself of the utility of the programmed course, the administrator visits another school using the course and satisfies himself that it works as "advertised."

The school then implements the programmed course and it fails!

The failure could be due to a number of factors. One possible explanation is that the administrator bought a system that was fine for another school, but that was not adaptable or suitable as a subsystem to his own school. The possible reasons for this are many: e.g., the teachers may not have accepted programmed instruction or the target learners in the school may have found the content or methodology inappropriate. The selected system did not interact as expected with the other subsystems, indicating a failure to design a total system.

A cost-benefit analysis is only as valid as the data on which it is based. If assumptions are made concerning the system's goals, the characteristics of the problem to be solved, and the solution's requirements, then the effectiveness of solution strategies and vehicles is dependent on the validity of the assumptions. Unless we have truly identified all the system's

needs, requirements, and characteristics, any trade-off between alternatives may be tenuous. Thus the reader is urged to make sure that, before using a solution-implementation mode, he assesses all the needs and states all the solution requirements (the first two steps of the six-step problem-solving model). It is a constant source of amazement to many system practitioners that people will select, produce, and implement solutions *before* the problem has been identified and substantiated.

Descriptive Mode

With this mode, the analyst is able to describe a system, either existing or required. Often with the use of charts and flow diagrams, the analyst can depict and study the conditions of any system or organization. An example of the use of this mode is a school organization chart, which describes how the school system is supposed to operate. A parallel chart also could be drawn showing the organization as it actually functions.

The descriptive mode performs the important function of describing either how a system actually operates or how it should operate. It does not identify what should be done to get from the current situation to a desired situation.

A definition of a *system* that is perhaps representative of a descriptive mode might be:

> The structure or organization of an orderly whole, clearly showing the interrelations of the parts to each other and to the whole itself (Silvern 1968)

Note that this definition does not include the requirement for a specific outcome for the system, but merely describes a system and the interactions of its parts. The descriptive mode seems to derive some of its ancestry from General System Theory, which describes the characteristics of any system or group of systems in terms of their identifying features, the interaction of their parts, and the extent to which the parts interact with the environment. General System Theory is an attempt to identify unifying strands for the various sciences, if not the universe (Ryan 1969 and Von Bertalanffy 1968). Both it and the descriptive mode are primarily descriptive and comparative.

A descriptive model of a system can be quite useful. It can portray, for example, the functions to be performed and the order in which they are to be performed in accomplishing any activity. Further, it is a useful means of "seeing" a total system at a glance; thus it affords an insight into the relevance and practicality of the total system and all its elements.

Note that the descriptive mode does not show what is to be done to get from "what is" to "what should be." The strength of this mode is in the graphic presentation of a system (or procedure), making it open and observable.

This getting from "what is" to "what should be" can be done several ways. Silvern proposes a Systems Approach model that views education as a "subset system" of social systems, i.e., a miniature system within society. Furthermore, he suggests that education be treated as "physical systems."

> (Attempts should be made) to model them as if they actually existed as networks of physical entities which have functions associated with them. The interconnections are signal paths or channels in which information flows and the functions may be considered as event processors—or information processors—but not necessarily as data processors or computer systems. (*Introduction* 1969)

Silvern disavows any attachment to "common sense rigorously applied," and seeks to develop models that can ultimately be treated as mathematical models. He refers to this approach differentially as "engineering" or "cybernetic."

Perhaps Silvern may be understood as suggesting a "mixed mode" of a System Approach. In this approach the descriptive tools of General System Theory and flow-charting techniques (which he calls "LOGOS" [1969]) are used to identify what should be done, and a simulation is then conducted to determine the optimum system. Silvern embraces the cybernetic concept that stresses the role of a self-correcting system process.

Other examples of this "cybernetic" approach likewise tend to be quite descriptive, in keeping with their General System Theory lineage.* Jamison and McLeod-Guertin (1969) report on an analysis that was performed relative to an internship program. They constructed two models, one for the program as perceived by the students and another for the program as perceived by the staff. In terms of a design-process mode referent, they could be said to have developed descriptive models for the two (need) dimensions of "what is" and "what is required."

One possible distinguishing characteristic of the "cybernetic" approach is the methodology that it commonly applies in reaching the required system outcomes. By varying system elements or subsystem characteristics, modeling and simulation are employed to determine the most

* An exceptionally lucid review of concepts and principles of General System Theory is provided by T. Antoinette Ryan (1969).

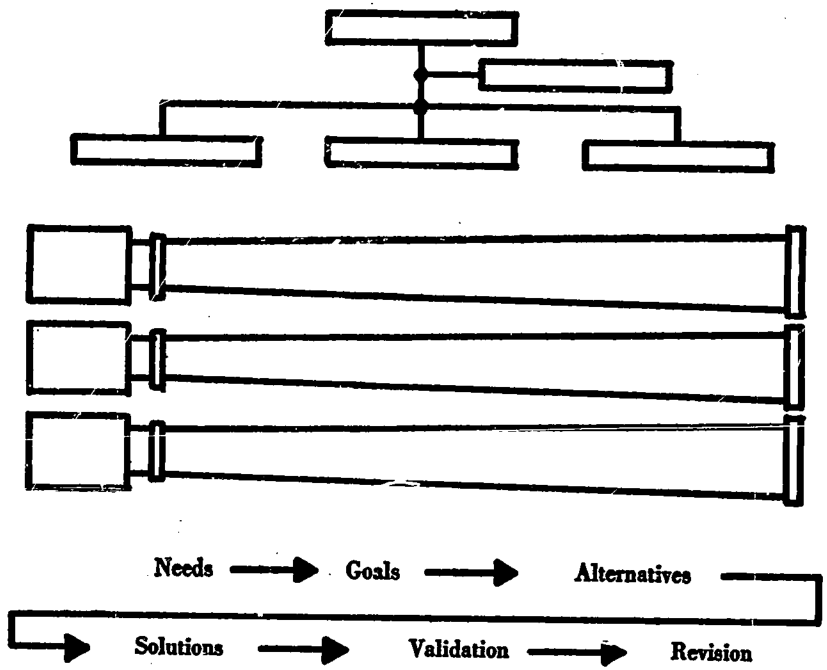
FIGURE 8
POSSIBLE SYSTEM APPROACH MODES AND EXAMPLES

Mode

DESCRIPTIVE

SOLUTION/IMPLEMENTATION

DESIGN PROCESS



effective and efficient system. This technique can be considered heuristic in nature.

In partial contrast, the design-process mode provides for the systematic application of analysis and synthesis to determine the requirements for problem solution and the possible strategies and tools for meeting the specified requirements. In this approach, modeling and simulation may be useful tools, but are not the only ones available.

Figure 8 illustrates the differences among the descriptive, solution-implementation, and design-process modes by depicting examples of the techniques used by each.

19

Possible Integration of Three System Approach Modes

A brief overview of three categories of System(s) Approaches has indicated that each may be of use to the educational administrator. The design-process mode builds a system to meet determined and substantiated needs. The solution-implementation mode uses tools, such as cost-benefit analysis, to identify and implement the "best" solution to a given problem, usually under the assumption that the problem is valid. The descriptive mode describes a current system or a required system to assure that all elements and interrelationships in the system are identified and integrated.

I do not wish to imply that any of the three modes is either correct or incorrect. (Nor do I intend to build or to replace current system theory.) Each is a viable tool for the educational manager in identifying and solving priority educational problems. Selection of any one of the modes should be made on the basis of the educational problem encountered. It is not a matter of which one to use in education, but rather a matter of which one to use when.

To emphasize the usefulness of the three modes, a possible integration

of them is offered. Figure 9 shows the suggested relationship among the descriptive mode, the solution-implementation mode, and the design-process mode. A major function of the descriptive mode, as the figure indicates, could be to identify the problem. It could be of use in obtaining and using needs assessment data and in portraying the dimensions of a need. It provides information relative to the current system or the required system, but does not specify what should be done to get from the current situation to the required situation.

Achieving the required system is the function of the solution-implementation mode. As the figure shows, this mode can be used to select the most effective and efficient solution strategies and tools, to implement them, to evaluate the performance for the total system, and to make required revisions. The solution-implementation mode thus conducts the functions of the "synthesis" portion of the design-process mode. In selecting solution alternatives, such system synthesis tools as cost-benefit analysis* are applied to insure further that requirements and objectives will be achieved.

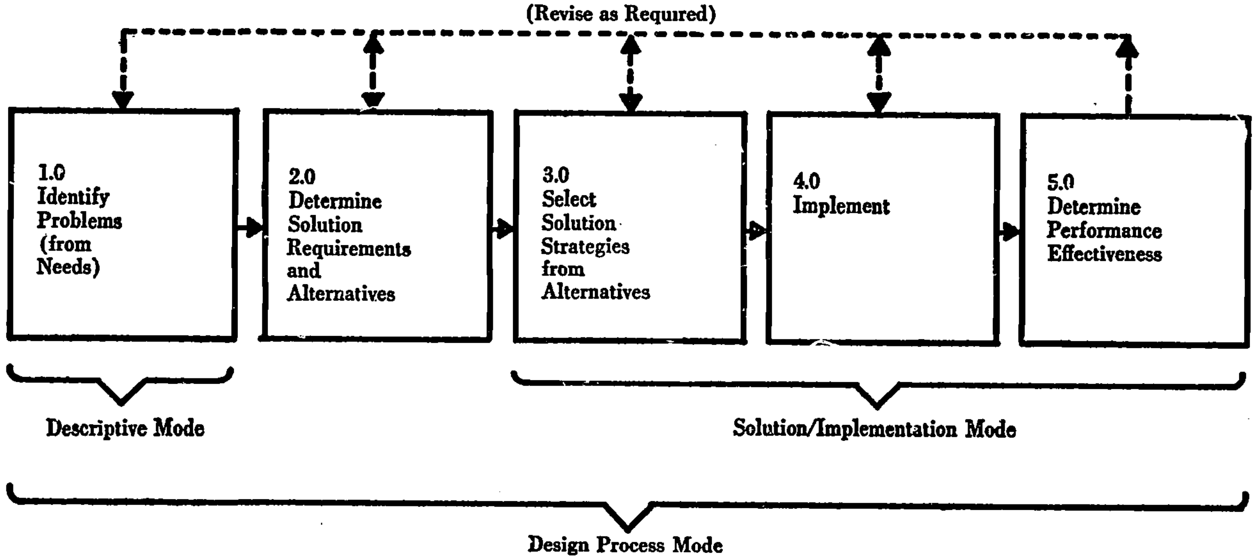
Only step two of the six-step design-process mode—determine solution requirements and alternatives—is not specifically covered by either the descriptive mode or the solution-implementation mode. This step is primarily accomplished by a set of tools associated with what I have referred to as system analysis. This step is one of determining all the functions that must be accomplished to get from the current system to the required system, and, along with this, identifying (but not selecting) possible solution strategies.

Borrowing a concept from mathematics, a "set-subset" relationship seems to exist among these modes of System(s) Approaches observed in the educational literature. The most generic, I have suggested, is the design-process mode. However, a solution of a specific problem relative to one or a few of the steps in the larger model might justify the use of either the descriptive or the solution-implementation mode alone. When used together in an overall problem-solving process, all three can be of use to the educator, be he a school superintendent or a classroom teacher.

Note that the integration of the three modes implies a number of assumptions. First, it assumes that the analyst does desire to start at the beginning to develop an effective and efficient system and that he is therefore unwilling to accept the current system as basically sound and only requiring an improvement in efficiency. It also assumes that the

* Cleland and King (1968) describe these tools as part of the "systems analysis process."

Figure 9
Interrelationship of Three Possible Modes for System Approaches to Education



data to be used in the system-design process are valid and that the analyst is objective in his use of the data and the tools of a System Approach.

This integrated approach often leads to the discovery that an operating system is less than functional and that a major redesign is necessary. Such findings are often met with less-than-enthusiastic greetings from other educators. Accordingly, before the educator commits himself to a System Approach to education, he should be aware that the road to relevant and practical education is usually a rocky and thankless one.

SUMMARY

In this chapter, I presented a number of "system" alternatives for use in educational management. If management is the process of identifying and reaching valid objectives in the most effective and efficient manner possible, then a critical function of the manager is to determine whether existing objectives are valid. To do this, first he must identify and define the discrepancies between "what is" and "what should be." Next he must design a process for getting from "what is" to "what should be" in the most effective and efficient manner possible. A system analysis may be performed to identify all the requirements for solution. Then, in order, the manager selects solutions from among alternatives, implements them, evaluates them, and revises the system as required. This process describes a self-correcting management model that I have called a design-process mode of a System Approach.

If, however, the manager's job is less than that of total system design, two other alternatives are available. If he is willing to accept the system's goals as given, he may well use the solution-implementation mode. He might also want to use the descriptive mode to describe the required outcome.

In my opinion, however, the management of the complexities of the educational process is, by and large, best begun from a design-process mode. Only in this way is it possible to base the educational system on documented educational needs that have been stated in behavioral terms.

20

Integration of a System Approach and Some Tools for the Quantitative Improvement of Education

As noted earlier, many things get called a "System(s)" Approach to education. Programs or projects so labelled include those that are intended to bring about a measurable change in learning, those that start with measurable behavioral objectives, those that offer a plan for reaching objectives, those that have a plan for considering the interaction of variables in reaching objectives, and those that attempt to improve the cost-effectiveness of education. All such programs or projects may be considered *parts* of a System Approach (design-process mode).

Also sometimes called "System(s)" Approaches are a number of tools and techniques that have much to offer in the quantitative improvement of educational outcomes. These tools and techniques have accompanied a marked shift in educational activities away from an intuitive approach and toward an empirical and even an evaluative framework for the systematic and measurable improvement of education. The most common of these tools and techniques are as follows:

1. Needs assessment
2. System analysis

3. Behavioral objectives
4. Planning-programming-budgeting systems (PPBS)
5. Methods-means selection
6. Network-based management tools, such as program evaluation review technique (PERT) and critical path method (CPM)
7. Testing and assessment

Although none of these tools fits the definition of a System Approach (design-process mode), each may be used in educational management and design as part of a System Approach. To show how the tools can be integrated with the System Approach, I will describe* each briefly and will then relate them to the six-step problem-solving process model that I described earlier as representing the design-process mode of a System Approach to education. I will not recommend any of the above tools over the others since each holds promise to educators for the measurable improvement of educational activities and outcomes.

Needs assessment. Many educators have become concerned not only with learning, but with the determination of *what* should be learned as a necessary prerequisite to achieving relevant learning outcomes. Needs assessments are formal attempts at determining what should be done and learned in schools. The first organized attempts at needs assessment in California, for instance, were made by many of the ESEA Title III PACE Centers, the results of which are covered by Sweigert (*Need* 1968, *Discovery* 1968, and 1969). Several school districts in California have or are implementing needs assessments, including Newport-Mesa Unified School District, Temple City Unified School District, Norwalk-La Mirada Unified School District, and Moreno Valley High School.

An early statewide effort to determine educational goals was instituted by the Pennsylvania State Department of Instruction in conjunction with the Educational Testing Service (ETS 1965). The Florida State Department of Education also has begun a statewide needs assessment.

A key concept of needs assessment seems to be that the relevance of an educational program must be empirically determined from the outset by a formal procedure that precedes educational planning, design, and implementation. Often needs assessment starts with the identification of symptoms. In most forms, it identifies and documents the discrepancies

* I have chosen to discuss these various tools and techniques only briefly because of the availability of excellent literature for each of them. Further information may be obtained from the references cited. See also "Systems Approaches to Educational Planning," by Marvin C. Alkin and James Bruno (part 4 of this monograph).

between "what is" and "what should be," and provides a valid starting point for education (cf. Kaufman 1968, Kaufman et al. 1969, and Kaufman and Corrigan *Steps* 1967).

System analysis. System analysis is a process for determining the requirements for getting from "what is" to "what should be." As conceived by Kaufman (1968) and Corrigan (1969), it consists of analysis, in levels or layers, of requirements for problem solution. Kaufman and Corrigan identify four steps in the process: mission analysis, function analysis, task analysis, and methods-means analysis. The outcome of a system analysis is a delineation of feasible "whats" for problem solution, and a listing of possible strategies and tools for achieving each "what."

Behavioral objectives. Most who have written about behavioral objectives agree on the desirability of stating learning outcomes in measurable performance terms (cf. Mager 1961, Popham 1967, and Smith 1964). Usually included in a behavioral objective are statements of what is to be done, by whom, under what conditions, and by what criteria. Although most discussions of behavioral objectives are concerned with the instructional process directly, the same criteria may be applied to other educational activities as well.

Planning-programming-budgeting systems. Perhaps first formally applied to national defense, PPBS represents an extremely powerful tool for educators. In the main, it provides a means for answering questions relative to "what do I give?" and "what do I get?" PPBS can be used to show, for various alternative methods and means, how product outcomes relate to the costs for achieving the outcomes. Some discussions of PPBS indicate that it starts with a "systems" analysis (or sometimes with a work breakdown structure or program structure) so that alternatives can be considered, projected, and evaluated. Many good, detailed references are available (Carpenter 1968, Katzenbach 1968, Parker 1969, Rath 1968, USAF 1968, U.S. Department of Defense 1967, and U.S. Government 1968).

Methods-means selection. Closely related to PPBS are procedures for deciding among alternative methods and means for achieving required outcomes. Briggs et al. (1967) offer a text on methods-means selection, and Corrigan (1965) has developed procedures for making effective and efficient methods-means decisions. Methods-means selection procedures are generally based on the specification of (1) the nature of the

learner, (2) the characteristics of available tools and strategies, and (3) the way the learning is to be accomplished. Cost-benefit is a key criterion (cf. Corrigan *System* 1966).

Network-based management techniques. Tools and techniques to aid in the management of large-scale projects were first developed for use on large weapons systems. Management of these weapons projects required knowing not only what was happening in the overall effort, but also how each part of the project might affect all the other parts. Network-based management techniques such as program evaluation review technique (PERT) and critical path method (CPM) provide this kind of knowledge. They are based on the notion that the parts of a system interact with and affect one another so that a change in any part of a system will have implications for other parts. This point of view represents a system concept rather than a linear concept of management.

Network-based management techniques have been adapted for use in education (cf. Cook), with three major results. First, the manager is forced to keep account of the entire educational system, including all its parts and their interactions. Second, the techniques provide an accountability and status procedure. And third, they provide a method for predicting outcome changes if conditions change unexpectedly.

Many discussions of network-based management techniques indicate a need to determine "what should be done" before scheduling and networking take place. Techniques that describe these requirements are often called "work breakdown structure." Such tools as PERT and CPM, however, are frequently used as descriptive project control tools; their users do not always rigorously plan and delineate requirements before constructing a network, but rather accept the existing requirements.

Testing and assessment. Testing, of course, is not new to education. In fact, many major testing tools of the past and present were developed by or for educators. Testing provides an understood manner for determining the effectiveness of any treatment and is an evaluation tool for determining the extent to which goals are achieved. New tests are being developed constantly.

Some recent developments in testing seem to offer promise to educators interested in planned change. One such development that relates to measurable performance objectives is "criterion-reference" testing (Glaser 1966), which provides an alternative to norm-referenced tests. Some major testing companies are developing criterion-referenced testing instruments.

National assessment, now under way, will provide empirical data relative to how well and how much the educational system is teaching our youngsters (Brain 1969).

The above tools, described very briefly, are of interest for several reasons: They are empirically grounded and attempt to quantify what is being or what should be accomplished in education; they often are being considered and in some cases are being used by educators; and in a few places they are legally mandated.

These tools are not unrelated. In the following section I suggest a way for relating them, each to the others and to an overall management model for the educational process.

An Attempt at an Integration of Educational Tools

If logical problem-solving may be said to follow the six-step model—or design-process mode of a System Approach—then it would seem critical to start the process with the advantage of having empirical data to document the problem. Such a beginning may be accomplished by an educational needs assessment. An assessment of needs might well tell us (perhaps only minimally) the discrepancies between "what is" and "what should be" so that a valid starting point can be identified.

After a needs assessment has been accomplished, and the specification of the two dimensions of problem solving stated, requirements must be further delineated to determine the subobjectives and the requirements for getting from where we are to where we ought to be. This analysis can be accomplished by the process tool called system analysis. This tool will provide detailed information concerning solution requirements, and will indicate possible alternative methods and means for accomplishing each requirement. Where instructional programs or management programs are being considered, the requirements may be stated in terms of behavioral objectives, that is, in measurable performance terms.

The third function identified in the problem-solving process model is to select solution strategies from among alternatives. The basic intent and tools of PPBS and cost-benefit analysis seem appropriate in performing this step. Based on the data obtained from the needs assessment and the system analysis (and possible statement of behavioral objectives), alternative outcomes and solutions can be considered before selection is made. Possible solutions might include programmed instruction, team teaching, differentiated staffing, inquiry methods, etc. By considering solutions in terms of the requirements to meet the documented

needs, relevance and practicality—rather than experience or availability—become the prime selection criteria.

Implementation is the step most familiar to educational practitioners. Such network-based techniques as PERT and CPM (Cook 1966 and 1967) have much to offer the implementer in managing and controlling his educational system.

The fifth step is to determine performance effectiveness. Testing and assessment procedures are natural tools for determining how well or how poorly the objectives have been achieved. Evaluation based on the determined requirements will tend to improve the validity of the testing-assessment procedure.

Thus we have what appears to be a useful relationship among all the foregoing tools for the improvement of education using a design-process mode of a System Approach to education—an overall problem-solving process. Figure 10 shows this suggested relationship.

Not all the above tools are completely independent. PPBS and network-based management techniques, for instance, are frequently preceded by a system analysis. Often, moreover, specification of behavioral objectives requires a system analysis and/or a needs assessment.

Conclusion

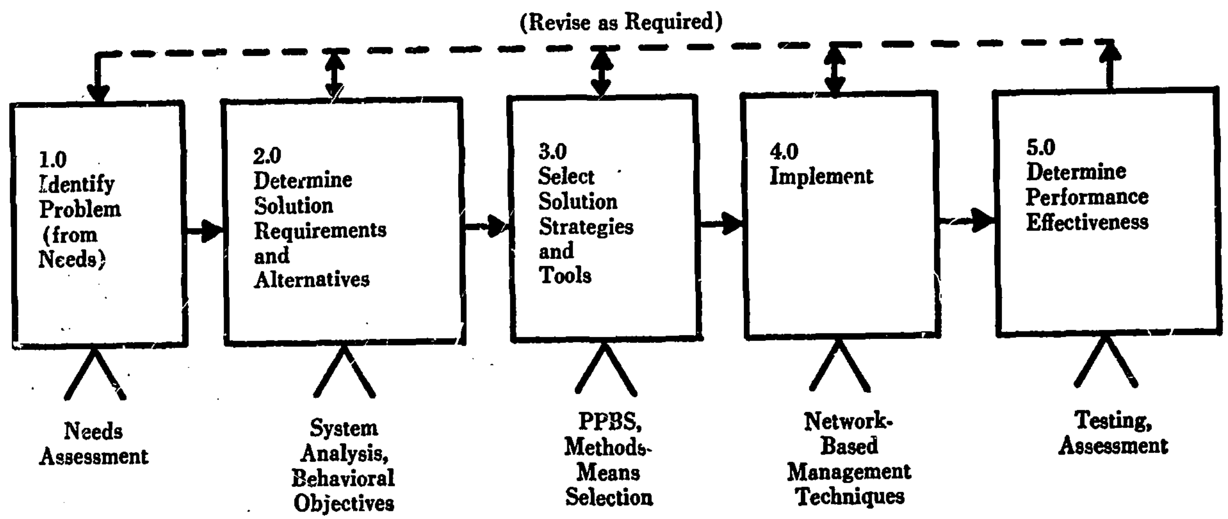
If the way is to be made clear for a cooperative attack on educational problems, educators must gain a common understanding of what has to be done and how to do it in an orderly, systematic manner. One possible step toward such common understanding may be agreement among educators on the uses of the various tools and techniques for the measurable improvement of education. Perhaps the integration of these tools presented here can provide the basis for this agreement and help to reduce or eliminate the current tendency toward fragmented efforts.

Cooperation among the users of these tools can take many forms. For instance, educators trying to specify minimal objectives for high-school graduation could work with other educators conducting needs assessments and system analyses to obtain data showing the validity of the graduation objectives. Likewise, those working on PPBS might also benefit from the outcomes of needs assessments, system analyses, and statements of behavioral objectives, to be thus assured that alternatives being considered are valid.

Out of such understanding and cooperation hopefully can emerge a systematic, empirical, and evaluative attack on current and future educational problems.

FIGURE 10

RELATIONSHIP OF CURRENT TOOLS FOR THE MEASURABLE IMPROVEMENT OF EDUCATION TO A POSSIBLE MODEL FOR EDUCATIONAL MANAGEMENT



21

Objections To System Approaches

Not everyone thinks that a System Approach should be applied to education. On the following pages I discuss several objections that have been raised against System Approaches. Later in the chapter I will attempt to clarify several misconceptions about System Approaches.

Fear of Change

Educators have become increasingly concerned with dynamics of change, rates of adoption of change, and problems of and obstacles to change (cf. Rogers 1962). If planned change is to occur, then the proper climate in which it is to occur must either exist or be created. Resistance to change is a widely noted phenomenon, not only in education but perhaps in every endeavor involving people. By examining the dynamics of change and the perceptions many people have of it, perhaps some of the objections to System Approaches can be better understood.

An important anthropological consideration of change is presented by Beals (1968), who discusses the effects of the rate of adoption of

technological innovations in terms of the contributing society and the receiving society. Quoting Malinowski (1945), Beals reminds us that:

> The two systems must develop a pattern of interrelationships but, because the very fact of innovation involves internal change in both systems, the pattern will be dynamic. In brief, however depressing it may be to orderly minds, what is successful today may not work tomorrow.

Continuing, Beals states:

> Technicians and planners often seem both surprised and distressed when resistances are encountered to innovations of obvious merit—obvious, at least, in the eyes of the innovators. Yet in fact resistance to change is normally to be expected at some point from some members of the receiving society. Even minor technological innovations not only may introduce new means to achieve established ends but may create new goals. In addition to requiring the establishment of new work habits, technological change involves some restructuring of social relationships. A relatively slight change may mean the obsolescence of one valued skill which gave status or economic security. More extended changes may destroy whole security systems for part of a population, alter relative statuses and economic positions, and redistribute power and leadership. All individuals and groups who perceive change to be to their disadvantage in any way will be resistant to them unless compensating advantages are presented or evident. Even to admit the superiority of the knowledge of another may involve intolerable loss of prestige or self-esteem in some societies. *The technological innovation which sooner or later arouses no resistance must be extremely trivial.* (Emphasis added)

It is not surprising that System Approaches have encountered heavy resistance, for they demand that professional educators undergo a major shift from a general institutional orientation to a learner orientation. Under a System Approach the teacher and the administrator are no longer regarded as "kings"; rather, the focal point of the educational system is the learner and his predictable achievement.

Needless to say, an educational agency, like any social institution, tends to be well organized toward maintaining the status quo. Any innovation or change poses a threat to persons within the system who maintain their status, position, and survival from that system. Even if a System Approach is but a formalization of past successful concepts and tools into a modern context, it will present some threat to the "Establishment." (Likewise, new varieties of System Approaches offered by various educators will elicit negative reactions from other "system supporters.")

Obviously, not all opposition to a System Approach or to any other innovation can be dismissed as arising from fear of change. Not every innovation is valid, meaning that objections can and should be raised against those that are either worthless or destructive. What I suggest, however, is that any time an objection is raised against an innovation (in this case, a System Approach), a viable alternative should also be submitted and subjected to empirical and experimental evaluation. Thus objectivity will tend to prevail over subjectivity and the possibility of maintaining the status quo only for the sake of the psychological and economic security of those in positions of authority will be lessened.

Some Philosophical Objections

Many people consider a System Approach dehumanizing, anticreative, and unresponsive to the essence of human life and freedom. An article by Hitt entitled "Two Models of Man" may help us to understand some of the philosophical objections to a System Approach. Hitt discusses two contemporary schools of thought relative to the understanding of man and the ways he may or may not be studied and treated. These two models of man are:

> The behavioristic model: Man can be described meaningfully in terms of his behavior; he is predictable; he is an information transmitter; he lives in an objective world; he is rational; he has traits in common with other men; he may be described in absolute terms; his characteristics can be studied independently of one another; he is a reality; he is knowable in scientific terms.
>
> The phenomenological model: Man can be described meaningfully in terms of his consciousness; he is unpredictable; he is an information generator; he lives in a subjective world; he is arational; he is unique alongside millions of other unique personalities; he can be described in relative terms; he must be studied in a holistic manner; he is a potentiality; he is more than we can ever know about him. (1969)

Hitt states that the acceptance of one model over the other has direct implications for many human activities, including "education, psychiatry, theology, behavioral science, law, politics, marketing, advertising and even parenthood." He concludes that truth appears to lie in both positions, and that their adherents should listen to each other.

Some objections to a System Approach may derive from a perception of it as based on the behavioristic model. Thus it is viewed as incapable of responding to all nuances and distinctly nonpredictable characteristics of humans in an educational context. Persons who object to a System Approach for this reason allege that the pursuit of such a materialistic

approach will result in the dehumanization of learners by putting them all into a single mold. This, they claim, will contribute to the ultimate degradation of our democratic society. In support of this claim, some cite the triviality of many of the measurable objectives that are used in some current educational activities.

To some extent, these objections could be true. There are many educators who would implement a nonresponsive System Approach or employ trivial objectives either for the sake of convenience or out of ignorance. On the other hand, the people who object to this "dehumanizing" approach might themselves be dehumanizing education by lock-stepping curriculum and learning processes, by limiting curriculum to a single state-adopted text, by providing learners with content material that is relevant only to the instructor, and by committing a host of other educational travesties—while still maintaining that other approaches will "dehumanize"!

To prevent these objections from ever being valid, an attempt should be made by anyone using a System Approach to make sure that, instead of destroying human potential and capability, it responds fully to the needs of learners and of society, both present and future. Learners should be provided with skills enabling them not only to survive in the current environment, but to reshape the culture and society for the benefit of all mankind.

Keep in mind that these skills, abilities, and anything else that is judged important by educators and those accountable for educational outcomes can be included in a System Approach.

If critical elements are not included in an educational system-design, then the accountable agent is the designer. In such a case, unresponsiveness should be immediately determined and corrected. The three most critical ingredients of a System Approach are (1) validity of input data, (2) integrity and objectivity, and (3) ability to state requirements in such terms as can be included in a system. Lack of any one of these ingredients can seriously impair the program's outcome.

The adherents of only the "behavioristic model" or of only the "phenomenological model" are missing the contributions of both positions. A System Approach is nothing more than a process for identifying and solving problems; it can produce anything that the analyst wishes it to produce, based on the validity of his data and on his objectivity in conducting the analysis, design, implementation, evaluation, and revision. If it is dehumanizing and unresponsive to real-world needs, it is because of the people who implement it, not because of the process itself. All it

offers is a systematic way to improve learner performance quantitatively and on an orderly basis. Just what are the alternatives? How well are we doing with the current approaches? These are the questions that must be answered by its opponents.

A System Approach Specifies Only Minimal Goals

A major source of confusion about System Approaches is the perception by some that they are intended to identify, define, and prescribe the *total* educational program and outcomes for learners. Such is not the intention. Most designers of System Approaches intend only to identify *minimal* requirements of achievement and to design an educational system that will, at least, achieve these required minimal outcomes. It is true that minimal expectations sometimes have a way of becoming the maximum, but such distortion is the fault of people rather than of any given approach. The remedy is one that needs exercising in any educational agency, that of quality control and quality assurance. Demonstration must be given, by performance, that the goals are not being used as *maximum* achievement specifications.

To assure that this distinction between minimum and maximum goals is made, some educational system designs include one set of functions for the identification of minimum objectives and another separate one for identifying enrichment objectives—those beyond the achievement of basic, fundamental skills and abilities.

The achievement of minimal skills is essential, particularly since most learning (and even current teaching) tends to assume the additive nature of learning. That is, any set of skills is said to build on the previous ones. For example, a learner must be able to read at a specified level of comprehension before he can appreciate Shakespeare. Often, however, we forget the basics and have our goals firmly planted in midair. Basics first, then enrichment, is a logical pathway to relevant, predictable learning and achievement.

Every educational innovation (good or bad) has had its detractors. The panic caused by programmed instruction is still fresh in memory. Opposition to behavioral objectives has also been expressed. Popham, in a paper presented in 1968 ("Probing the Validity of Arguments Against Behavioral Goals"), summarizes and responds cogently to commonly stated objections to measurable behavioral objectives. Many of the same objections discussed by Popham seem to be leveled against a System Approach to education.

TERMINOLOGY

Additional confusion regarding System Approaches stems from terminology. Some words used by system practitioners seem strange, even cold and surgical in connotation. Such words as "mission" and "tradeoff" apparently have conveyed to some educators a dehumanization that is not intended. What is intended, rather, is precision in language so that each word has an operational definition distinctly its own. Every discipline tends to create its own language because the existing language does not convey the meanings intended for precise communication.

Although at first troublesome and difficult to understand, the new system terminology is essential if its users are to avoid confusion in communicating with one another. To balk at the new terminology is to risk comparison to a student entering the first grade who refuses to learn new words because he feels he is doing all right with what he has.

IS A SYSTEM APPROACH FEASIBLE?

Another type of objection to a System Approach is frequently expressed as follows: "This is all fine, but I don't have time to do all the work it entails." Implicit in this argument is tacit agreement with the basic objectives and process tools of a System Approach, but a denial of them because of lack of time to conduct the required tasks. System Approaches are thus said to be valid but not feasible.

Although this lack of time may be a true statement of affairs in most of our nation's schools, it does not relieve educators from the responsibility of obtaining the resources necessary to provide responsive, practical education. If educators lack the time and resources to plan and implement a System Approach, then these resources must be made available. Perhaps the reason they are not made available is that educators have not yet convinced those who control the budgets that viable alternatives to present methods do exist. A System Approach is such a viable alternative since it promises predictable results at a predictable price.

Most people, including taxpayers and school board members, tend to make decisions on the basis of "what do I give" and "what do I get." If educators could demonstrate a systematic procedure for achieving specified outcomes (even if only minimal outcomes), perhaps the taxpaying public would be more inclined to pay for *planned* measurable change.

SOME OBJECTIONS AND WARNINGS FROM SYSTEM "INSIDERS"

Some objections to system analysis, System Approaches, and their variations are raised by people who admit the usefulness of these tools

in education. Although some of their warnings are valid, others either are imaginary or stem from a persistent problem in the field—lack of agreement on definitions of terms and concepts.

Let me examine a few of these objections by system insiders. First is the objection to the view that the System Approach and the scientific method are related. Carter states:

> It is sometimes said that system analysis is simply the application of the scientific method to solving problems in the applied world. I believe this is not a sound analogy. As I see it, the scientific method is germane to a different domain in the sense that it tends to define methods which are uniquely applicable to problems in a research setting. The scientific method, in a way, is more powerful than system analysis because its methods are older and better developed; it is more sensitive to the test of empirical data, and the logic and rigor of testing hypotheses is greater than can be the case in system analysis. Indeed, one of the problems in trying to apply system analysis is that the analysis tends too frequently to be mainly intellectually analytic; it emphasizes paper and pencil analysis, simulation or modeling, rather than empirical and experimental methods. Nevertheless, the careful, systematic, and thorough examination of the many different facets in a major attack on the development program is valuable, and in many instances has led to programs which were better conceived and more successful than had system analysis not been applied. (1969)

A related objection has been expressed by Trzebiatowski:

> The key difference between the scientific method and the system method can be found in the final step of both methods; that is, in the scientific method the research findings lead, hopefully, to a greater and more comprehensive theory, and in the system method the re·rearch findings yield a direct and immediate plan of action. (1967)

Trzebiatowski further states:

> Education can benefit from both methods. However, until recently only the scientific methodology has been utilized to any great extent in educational research; today, a growing number of educational researchers are becoming interested in applying the system methodology to educational problems. (1967)

These comments by successful and highly capable system practitioners in education emphasize a difference, either in purpose or in methodology, between the scientific method and a System Approach.

I suggest, however, that these differences may be more apparent than real. If it is the intent of the user that distinguishes the two methodologies—to create a theory in the case of the scientific method and to create a learning system in the case of a System Approach—then the distinction

seems to be of little import. Regardless of the kinds of problems, the steps to achieve a solution are the same—a plan of action or a theory that is testable and generalizable.

The six-step problem-solving model describes a process that is usable whether it be applied by a system engineer trying to produce a less polluting automobile or by an educator trying to develop a measurably more responsive educational system.

The physicist, the engineer, the psychologist, the educator, whether using a System Approach or the scientific method, still must demonstrate with measurable performance data the extent to which they have achieved their objectives.

It is true, as some have indicated, that the tools of scientific inquiry in the physical and applied sciences are much further developed than those in education. Educators face a severe problem in that their data tend to come in the form of nominal, rational, and ordinal-scale properties, with higher-order data rarely obtainable. Nevertheless, the *process* of inquiry seems to be the same among all the disciplines. Only the *tools* vary, as perhaps they should, since the subject area of each discipline is unique.

Within education alone, the analytical tools of system analysis, modeling, and simulation are simply alternative ways of experimentation. Occasionally, educators also use symbols and mathematical models (cf. Brooks 1969) to try to reproduce the real world in a laboratory or remote environment. The solution process still involves the six-step model or some variation, for example, Carter's eight steps (1969) or Lehman's seven steps (1968).

Still other concerns are voiced by some system insiders. Hartley (1969), for example, a strong proponent of "systems analysis," lists twenty-five limitations of the approach falling under "three basic categories: (1) conceptual (problems of theoretical definition); (2) operational (problems of administrative execution); and (3) societal (problems of environmental relevance)." Many of his objections stem from users being confused over the terminology of System Approaches or not understanding what they are. For instance, one limitation noted by Hartley is "monumental computer errors." Since a System Approach process model says nothing at all about computers, why should computer error even be considered as a limitation? Equating "systems" with "computers" can be a serious error, for it is an example of selecting a "how" before the "whats" have been determined.

22

Prospects and Conclusion

At this point I wish to gaze into my crystal ball and offer speculations about the future of System Approaches in education. My speculations, although based in part on data, are admittedly also formed by my own biases, fears, hopes, and desires.

System Approaches To Be Implemented, Improved

Integration of the several System Approaches will occur as confusion over the terminology of system concepts diminishes and as the concepts become increasingly defined in operational terms. (As an example of confusion over terminology, recall that some use the term "systems analysis" to mean the process of selection from among alternatives, while others have used it to describe a process for determining solution requirements—one is working in determining "how" while the other is in the realm of determining "what.")

Gradually, as the concepts get more defined and more operational, the

process and its associated methodology will be more favorably received by practitioners, who will begin to view it as another tool for improving education. Tested by use, the System Approaches themselves will be revised and improved.

Educators will become more outcome (or product) oriented. As their use of system tools and models increases, they will begin viewing education as an accountability system in which everyone has a role to play in achieving required outcomes. Accordingly, teaching adequacy will not be judged by tenure or academic degrees, but by determination of "learning per class of learners," and will be rewarded on the basis of product rather than on the current basis of process. Educators also will recognize the utility of system thinking and system processes in identifying and achieving their goals, and will become active participants in the planning of educational change.

As educators use and misuse the various modes of System Approaches, educational system practitioners will continue to squabble among themselves for tribal ascendancy; the truism that egos are the scourge of progress will be confirmed. Soon, however, this antagonism will pass, and those who have worked so hard to develop and to present system tools for education will devote renewed attention to the further expansion of these fledgling but potentially powerful tools.

The process of education will become similar to the design-process mode of a System Approach and will realize effectiveness, efficiency, and humanization to an extent that will even amaze the "phenomenological" doubters. That this mode will be used ultimately in education (though perhaps in modified form) is because it requires the problem-solving process to begin with needs—needs that are based on hard empirical data and not on feelings or the desires of special interests.

Application of the process to education will require the reallocation of functions within schools along lines similar to those suggested in differentiated staffing. However, the allocation of functions and tasks among various educational practitioners and paraprofessionals will be on the basis of delineated requirements and matching capabilities, not historical precedent or tenure. It will be seen that an educational system can be humane, effective, and efficient simultaneously and that these qualities are not mutually exclusive.

Pet schemes and formulations (including this one) will go by the boards, and new and more functional ones will take their place, also to be

replaced in a true self-correcting system fashion. Regardless of the name, the System Approach* will endure, be improved, and be used.

WHERE TO GO FROM HERE

Further information about System Approaches and their implementation can be obtained from numerous sources. The reader might first want to seek the advice of practitioners in the "system art," many of whom are listed in the bibliography. (Inclusion of a reference in this writing is neither an endorsement nor a condemnation since only a sample of the extensive literature on this subject could be listed. Many good contributions were therefore left unrecognized.)

When conferring with an authority on System Approaches, determine his emphasis (design process, descriptive, or solution implementation) and match it against your requirements. You may want to hear from several experts whose emphases vary. Also keep in mind that additional alternatives may exist that are not covered in this work. Reading other literature on System Approaches will help to clarify or even to correct some of the conceptions presented in this paper; the bibliography represents a limited starting point. For help in implementing a System Approach, many colleges and universities have programs that teach some of the detailed skills and overall concepts involved.

Finally, why not try to apply the design-process mode yourself: List your needs and their supporting data, rank these needs in order of priority, select one, and then determine the requirements for meeting the need. List all the alternative solutions and their advantages and disadvantages, and select those that will be most effective and efficient. After implementing the solutions, evaluate them in terms of the extent to which they helped you achieve your objective: Data, models, processes, consultants, and even authors might all best be evaluated in such a System Approach manner.

CONCLUSION

Although the road educators must take to arrive at a common understanding of System Approaches is a rocky one, I contend that it soon will be a smooth freeway. I hope that this explanation of the process will help to provide some of the construction material for that new road. What

* Perhaps the first thing that needs changing is the term "System Approach." Many problems in the field today are traceable to confusion over the word "system" and its variations. The Greek compound "*Panparametrics*" might be considered as an alternative in that it emphasizes "all parameters." Another possible alternative is "*Panametrics*," which suggests the requirement to measure all aspects.

is required is a common set of process understandings so that relevant and practical tools can be identified, implemented, evaluated, and revised. Before this occurs, educators must begin to make careful distinctions between "what" and "how," between "products" and "processes," and between "means" and "ends," while also acknowledging how these features interrelate.

Carter sums it up well when he states:

> System analysis represents the formalization and the procedural expression of the approach that wise, systematic and successful men have always taken in trying to solve their problems. In education it has a particular applicability because it places much emphasis on the problems of implementation, evaluation, feedback, and revision—an emphasis which should be highly welcome in today's complex education milieu. (1969)

To this summary we might add only that the design-process mode of a System Approach also emphasizes assessment and delineation of needs, and the specification of requirements to meet the needs.

Bibliography

Atkinson, R. C. "Computerized Instruction and the Learning Process." *American Psychologist*, April 1968, pp. 225-239.

Banathy, B. H. *Instructional Systems.* Palo Alto, California: Fearon Publishers, Inc., 1968, 106p.

Barson, J., and Heinich, R. "A Systems Approach." *Audiovisual Instruction*, June 1966.

Barson, J., and Oxhandler, E. K. "Systems: An Approach to Improving Instruction." *Audiovisual Instruction*, May 1965.

Beals, R. L. "Resistance and Adaptation to Technological Change: Some Anthropological Views." *Human Factors*, December 1968, pp. 579-588.

Bern, H. A. "Audiovisual Engineers?" *AV Communication Review* 9 (July-August 1961): 186-194.

Bern, H. A. "Wanted: Educational Engineers." *Phi Delta Kappan*, January 1967.

Brain, G. B. "What's the Score on National Assessment?" *California Teachers Association Journal*, May 1969, pp. 3-8.

Brickell, H. M. *Organizing New York State for Educational Change.* New York: New York State Department of Education, December 1961.

Briggs, L. J., and others. *Instructional Media: A Procedure for the Design of Multi-Media Instruction.* Pittsburgh: American Institutes for Research, 1967.

Briggs, L. J., and Tallmadge, G. K. *Plan of Action To Be Followed by Contractors in Developing Each of Four Proposed Multi-Media Courses on Instruction for the U.S. Naval Academy.* Pittsburgh: American Institutes for Research, 1967. (AIR-F-63-2/67FR).

Brooks, C. N. "Training System Evaluation Using Mathematical Models." *Educational Technology*, June 1969, pp. 54-61.

Buckley, W., ed. *Modern Systems Research for the Behavioral Scientist.* Chicago: Aldine Publishing Co., 1968, 525p.

Carpenter, C. R. *New Teaching Aids for the American Classroom.* Palo Alto, California: Institute for Communications Research, Stanford University, 1960. Reprinted by DHEW, 1962. (E-34020).

Carpenter, M. B. "Program Budgeting as a Way To Clarify Issues in Education." RAND Corporation, 1968.

Carter, L. F. "The Systems Approach to Education—The Mystique and the Reality," report SP-3291. System Development Corporation, 1969.

Carter, L. F., and Siberman, H. "The System Approach, Technology, and the School," report SP-2025. System Development Corporation, 1965.

Charters, W. W. "Is There a Field of Educational Engineering?" *Educational Bulletin*, Ohio State University, 1954.

Churchman, C. W. *The Systems Approach.* Delacorte Press, 1968.

Clark, J. W., ed. *Systems Education Patterns on the Drawing Boards for the Future. Highlights of the Second Annual National Conference on General Systems Education.* Cheshire, Connecticut: 1968, 42p.

Cleland, D. I., and King, W. R. *Systems Analysis and Project Management.* New York: McGraw-Hill, 1968. 315p.

Cleland, D. I., and King, W. R. *Systems, Organizations, Analysis, and Management: A Book of Readings.* McGraw-Hill, 1969, 383p.

Cogswell, J. F. "System Technology in Education." In *Man-Machine Systems in Education*, G. W. Loughary, et al. New York: Harper and Row, 1966.

Cook, D. L. "Better Project Planning and Control through the Use of System Analysis and Management Techniques." Paper presented at Operations Analysis of Education Symposium. Washington, D.C.: November 1967.

Cook, D. L. *A Generalized Project Management System Model.* Columbus, Ohio: Educational Program Management Center, Ohio State University, 1968.

Cook, D. L. "An Overview of Management Science in Educational Research." Paper presented to the Symposium on Management Science in Educational Research. Columbus, Ohio: Educational Program Management Center, Ohio State University, September 1968.

Cook, D. L. "PERT: Applications in Education." Washington, D.C.: U.S. Government Printing Office, 1966. (Cooperative Research Monograph no. 17 OE-12124).

Corrigan, R. E. *The Development of Group Tutorial Instructional Methods at Alamitos School District.* Garden Grove, California: undated.

Corrigan, R. E. *Method-Media Selection.* California: Tulare County Department of Education, Operation PEP, 1965.

Corrigan, R. E. "Programmed Instruction as a Systems Approach to Education." In *Trends in Programmed Instruction*, edited by G. Ofiesh and

W. C. Meierhenry. Washington, D.C.: National Society for Programmed Instruction, and National Education Association Department of Audiovisual Instruction, 1966.

Corrigan, R. E. *System Cost/Effectiveness Criteria for Selecting the Proper Resources and Plans To Achieve Stated Mission Objectives.* California: Tulare County Department of Education, Operation PEP, 1966.

Corrigan, R. E., and associates. *A System Approach for Education (SAFE).* Garden Grove, California: 1969.

Corrigan, R. E.; Corrigan, Betty O.; and Kaufman, R. A. *The Steps and Tools of the System Synthesis Process in Education.* San Mateo, California: San Mateo County Department of Education, Operation PEP, 1967.

Corrigan, R. E., and Johnson, D. W. *The Requirements and Process for Planned Educational Change.* California: Tulare County Department of Education, Operation PEP, 1966.

Corrigan, R. E., and Kaufman, R. A. *Why System Engineering.* Palo Alto, California; Fearon Publishers, Inc., 1966, 80p.

Educational Testing Service. *Highlights of a Report from Educational Testing Service to the State Board of Education of the Commonwealth of Pennsylvania. A Plan for Evaluating the Quality of Educational Programs in Pennsylvania.* Princeton, New Jersey: 1965.

Eldridge, P. *Maxims for a Modern Man.* Cranbury, New Jersey: A. S. Barnes, 1965.

English, F. W. "Change Strategies That Fail." *California School Boards,* May 1969, pp. 16-19.

Erikson, B. "A Systems Approach to Educational Technology (with Special Reference to Swedish Conditions)." *Educational Technology,* June 1969, pp. 62-69.

Etzioni, A. *Modern Organizations.* Foundations of Modern Sociology series. Englewood Cliffs, New Jersey: Prentice-Hall, 1964.

Finn, J. D."Technology and the Instructional Process." *AV Communication Review* 8 (Winter 1960): 5-26.

Fisher, G. H. "The Analytical Bases of Systems Analysis." In *Systems, Organizations, Analysis, and Management: A Book of Readings,* D. I. Cleland and W. R. King. New York: McGraw-Hill, 1969, pp. 206-215.

Gagne, R. M., ed. *Psychological Principles in System Development.* New York: Rinehart and Winston, 1962.

Gerard, R. W., ed. *Computers and Education.* New York: McGraw-Hill, 1967, 307p.

Gerletti, R. C. "Producing an ITV Program." *Educational Television,* June 1969, pp. 15-17.

Gibson, T. L. "Instructional Systems Design through Inservice Education." *Audiovisual Instruction,* September 1968, pp. 710-714.

Glaser, R. "Psychological Bases for Instructional Design." *AV Communication Review,* Winter 1966.

Hanna, P. R. Phase II Final Report: *Curriculum Innovations for the State's*

Quality Growth as We Approach 2000 A.D. Berkeley, California: State Commission in Public Education, 1966.

Harris, Louis. "What People Think about Their High Schools, the *Life* Poll." *Life*, 16 May 1969, pp. 22-39.

Hartley, H. J. "Limitations of Systems Analysis." *Phi Delta Kappan*, May 1969, pp. 515-519.

Hartley, H. J. "Twelve Hurdles To Clear before You Take on Systems Analysis." *American School Board Journal*, July 1968, pp. 17-18.

Hitt, W. D. "Two Models of Man." *American Psychologist*, July 1969, pp. 651-658.

Hoban, C. F. "The Usable Residue of Educational Film Research." In *New Teaching Aids for the American Classroom*, edited by W. Schramm. Palo Alto, California: Institute for Communications Research, Stanford University, 1960. (Reprinted by U. S. Dept. of Health, Education & Welfare.)

Holland, J. G., and Skinner, B. F. *The Analysis of Behavior*. New York: McGraw-Hill, 1961, 337p.

Holtz, J. N. "An Analysis of Major Scheduling Techniques in the Defense Systems Environment." In *Systems, Organizations, Analysis, and Management: A Book of Readings*, D. I. Cleland and W. R. King. New York: McGraw-Hill, 1969, pp. 317-355.

Jamison, C., and McLeod-Guertin, J. "Two System Models for Educational Planning." *Educational Technology*, June 1969, pp. 29-31.

Johnson, D. W. "A Look at the Future of California Education." *California School Boards*, November 1967.

Katzenbach, E. L. *Planning, Programming Budgeting Systems: PPBS in Education*. The New England School Development Council, 1968.

Kaufman, R. A. "An Educational Management System." Paper presented to the Third Annual Conference on Innovations in Educational Management. Fort Lauderdale, Florida: Nova University, 14 April 1969, p. 15.

Kaufman, R. A. *A Preliminary Selected Bibliography of System Analysis and System Synthesis as It Relates to Education and Training*. California: San Mateo County Department of Education, Operation PEP, 1967.

Kaufman, R. A. "A System Approach to Education: Derivation and Definition." *AV Communication Review*, Winter 1968.

Kaufman, R. A. "The System Approach, Programmed Instruction and the Future." Paper presented to the New York University Thirty-Fifth Annual Junior High Conference, May 1962.

Kaufman, R. A. "A System Approach to Programming." In *Trends in Programmed Instruction*, edited by G. Ofiesh and W. C. Meierhenry. Washington, D.C.: National Society for Programmed Instruction and National Education Association Department of Audiovisual Instruction, 1964.

Kaufman, R. A.; Clinkenbeard, W.; and Wood, R. *A Generic Educational Planning Model*. Los Angeles, California: The Los Angeles County Supplementary Education Center, May 1969.

Kaufman, R. A., and Corrigan, R. E. *The Steps and Tools of System Analysis*

as Applied to Education. California: San Mateo County Department of Education, Operation PEP, 1967.

Kaufman, R. A.; Corrigan, R. E.; Corrigan, B. O.; and Goodwin, D. L. *Functional Analysis in Education.* California: San Mateo County Department of Education, Operation PEP, 1967.

Kaufman, R. A.; Corrigan, R. E.; Corrigan, B. O.; and Goodwin, D. L. *Mission Analysis in Education.* California: San Mateo County Department of Education, Operation PEP, 1967.

Kaufman, R. A.; Corrigan, R. E.; Corrigan, B. O.; Goodwin, D. L.; and Levine, S. L. *Task Analysis in Education.* California: San Mateo County Department of Education, Operation PEP, 1967.

Kaufman, R. A.; Corrigan, R. E.; and Johnson, D. W. "Toward Educational Responsiveness to Society's Needs—A Tentative Utility Model." *Journal of Socio-Economic Planning Sciences* 3 (August 1969): 131-157.

Kaufman, R. A.; Corrigan, R. E.; and Nunnelly, C. L. "The Instructional System Approach to Training." *Human Factors* 8 (April 1966).

Kaufman, R. A., and Harsh, J. Richard. "Determining Educational Needs—An Overview." Paper prepared for the PLEDGE Conference, San Dimas, California, October 1969.

Kaufman, R. A.; Rand, M. J.; English, F.; Conte, J. M.; and Hawkins, W. *An Attempt To Put the Ten Objectives of Education Developed for Pennsylvania by Educational Testing Service into Operational Definitions.* Temple City Unified School District, April 1968. (Available from Los Angeles County Supplementary Education Center)

Kershaw, J. A., and McKean, R. N. "Systems Analysis and Education." RAND Corporation Research Memorandum 2473-FF, October 1959).

Kochman, A. F. "Educational Applications of the System Analysis and System Synthesis Processes," System Development Corporation, report SP-3365. May 1969.

Lehmann, H. "The Systems Approach to Education." *Audiovisual Instruction*, February 1968.

Lynn, L. E., Jr. "Systems Analysis—Challenge to Military Management." In *Systems, Organizations, Analysis, and Management: A Book of Readings.* D. I. Cleland and W. R. King. New York: McGraw-Hill, 1969, pp. 216-231.

MacDonald, R. H. *A Programmed Instructional Course in the Management Process and an Information System To Support Its Decision-Making Responsibility.* Orange, California: Chapman College, 1969.

Mager, R. F. *Preparing Instructional Objectives.* Palo Alto: Fearon Publishers, Inc., 1961, 80p.

Mager, R. F. *Preparing Objectives for Programmed Instruction.* Palo Alto: Fearon Publishers, Inc., 1962, 62p.

Mauch, J. "A Systems Analysis Approach to Education." *Phi Delta Kappan*, January 1962, pp. 158-62.

Meals, D. "Heuristic Models for Systems Planning." *Phi Delta Kappan*, January 1967, pp. 199-203.

Miller, R. B. *A Method for Man-Machine Task Analysis.* Wright Air Development Division, U.S. Air Force, American Institutes for Research, December 1954. (WADC Technical Report 54-563).

Mood, A. M. "Some Problems Inherent in the Development of a Systems Approach to Instruction." Paper prepared for the Conference on New Dimensions for Research in Educational Media Implied by the "Systems Approach to Instruction." Syracuse, New York: Center for Instructional Communication, Syracuse University, 2-4 April 1964.

Morgan, C. T.; Cook, J. S.; Chapanis, A.; and Lund, M. W. *Human Engineering Guide to Equipment Design.* New York: McGraw-Hill, 1963.

Morrill, C. S. "Setting Programmed Instruction Objectives Using a Systems Methodology." In *Trends in Programmed Instruction,* edited by G. Ofiesh and W. C. Meierhenry. Washington, D.C.: National Society for Programmed Instruction, and National Education Association Department of Audiovisual Instruction, 1964.

Morrison, E. J. "Defense Systems Management: The 375 Series." In *Systems, Organizations, Analysis, and Management: A Book of Readings,* D. I. Cleland and W. R. King. New York: McGraw-Hill, 1969, pp. 80-89.

Ofiesh, G. D. *Programmed Instruction: A Guide for Management.* New York: American Management Association, 1965.

Ofiesh, G. D., and Meierhenry, W. C., eds. *Trends in Programmed Instruction.* Washington, D. C.: National Association for Programmed Instruction and National Education Association Department of Audiovisual Instruction, 1964.

O'Toole, J. F., Jr. "Systems Analysis and Decision-Making in Education," report SP -2020/000/01. Santa Monica, California: System Development Corporation, June 1965.

Parker, S. "PPBS." *California Teachers Association Journal,* May 1969, pp. 9-11.

Popham, W. J. "Proving the Validity of Arguments against Behavioral Goals." Paper presented to the American Educational Research Association, Chicago: February 1968.

Popham, W. J. *Setting Behavioral Objectives.* Los Angeles: University of California at Los Angeles, 1967.

Porter, E. H. "The System Thinker, Parables and Paradigm," report SP-285. System Development Corporation, 1961.

Quade, E. S. "Systems Analysis Techniques for Planning-Programming-Budgeting." In *Systems, Organizations, Analysis, and Management: A Book of Readings,* D. I. Cleland and W. R. King. New York: McGraw-Hill. 1969, pp. 193-205.

Rath, G. J. "PPBS Is More Than a Budget: It's a Total Planning Process." *Nation's Schools* 82 (November 1968).

Rogers, E. M. *Diffusion of Innovations.* Glencoe, Illinois: The Free Press of Glencoe, 1962.

Roshal, S. *Personal Communication.* July 1968.

Ryan, T. A. "Systems Techniques for Programs of Counseling and Counselor Education." *Educational Technology*, June 1969, pp. 7-17.

Shannon, C. E., and Weaver, W. *The Mathematical Theory of Communication.* Urbana, Illinois: University of Illinois Press, 1949.

Silvern, L. C. "Cybernetics and Education K-12." *Audiovisual Instruction*, March 1968.

Silvern, L. C. "Introduction." *Educational Technology*, June 1969, pp. 3-6.

Silvern, L. C. "LOGOS: A System Language for Flowchart Modeling." *Educational Technology*, June 1969, pp. 18-23.

Silvern, L. C. *Studies in the Systems Engineering of Education, No. 1: Basic Data on the Evaluation of Systems Thinking in Education.* Los Angeles, California: University of California; University of Southern California, Department of Instructional Technology, 1965.

Smith, R. G. *The Design of Instructional Systems.* The George Washington University, Human Resources Research Office, TR 66-18, November 1966.

Smith, R. G. *The Development of Training Objectives.* The George Washington University Human Resources Research Office, Bulletin 11, June 1964.

Smithies, A. "Conceptual Framework for the Program Budget." In *Systems, Organizations, Analysis, and Management: A Book of Readings*, D. I. Cleland and W. R. King. New York: McGraw-Hill, 1969, pp. 163-182.

State University of Iowa and NEA Department of Audiovisual Instruction. *Summary Report of the Second Lake Okoboji Audio-Visual Leadership Conference.* August 19-22, 1965.

Stolurow, L. M. *Some Educational Problems and Prospects of a Systems Approach to Instruction.* Urbana, Illinois: University of Illinois, Training Research Laboratory, March 1964.

Sweigert, R. L. "The Discovery of Need in Education: Developing a Need Inquiry System." *Journal of Secondary Education*, December 1968.

Sweigert, R. L. "The First Step in Educational Problem Solving—A Systematic Assessment of Student Benefits." A working paper prepared for California State Department of Education, October 1969. 55p.

Sweigert, R. L. *Need Assessment—the First Step toward Deliberate Rather Than Impulsive Response to Problems.* California: California State Department of Education, 1968.

Tanner, C. K. "Techniques and Application of Educational Systems Analysis." *Audiovisual Instruction*, March 1969.

Trzebiatowski, G. L. "An Evaluation of the Instructional Systems Approach in Higher Education." Unpublished Ph.D. dissertation, Michigan State University, 1967, 197p.

Tucker, J. A. "A Systems Approach to Effective Performance." In *Programmed Instruction: A Guide for Management*, G. Ofiesh. New York: American Management Association, 1965.

U. S. Air Force System Command. *System Engineering.* Manual 375-5. 1965.

U. S. Air Force System Command, *Work Statement Preparation.* Manual 70-5. 1 February 1968.

U. S. Department of Defense. *Performance Measurement for Selected Acquisitions.* DOD Instruction 7000. 2. 12 December 1967.

U. S. Government. *Military Standard 881—Work Breakdown Structure for Defense Material Items.* 1 November 1968.

VanderMeer, A. W. "Systems Analysis and Media—a Perspective." *AV Communication Review* 12 (Fall 1964) : 292-301.

Von Bertalanffy, L. "General System Theory—A Critical Review." In *Modern Systems Research for the Behavioral Scientist,* edited by W. Buckley. Chicago: Aldine Publishing Company, 1968.

Weiner, N. "Cybernetics in History." In *Modern Systems Research for the Behavioral Scientist,* edited by W. Buckley. Chicago: Aldine Publishing Company, 1968.

Wright, L. O. and Furse, B. S. *Developing Comprehensive Planning Capability in State Education Agencies.* Salt Lake City, Utah: Utah State Board of Education, 1969, 39p.

Part IV

Systems Approaches
To Educational Planning

Marvin C. Alkin and James E. Bruno

23

Introduction

A major function of educational administrators is to make decisions. Many of these decisions require keen intuitive understanding of the complexity and interrelationships of the social systems and milieus that encompass the schools. However, school management, especially the making of educational decisions that involve choices among costly alternatives, requires more than intuitive judgment. Procedures and techniques need to be employed that permit a more precise evaluation of the consequences of alternatives before decisions are made, so that the ultimate decisions will be sound. This is especially true of "planning decisions"—those related to future time frames.

No procedures are available or envisaged that can do the planning for the educational administrator or that are capable of making any but the most routine decisions for him. The methodologies we will discuss

Marvin Alkin was primarily responsible for writing this paper. The major portion of the bibliographic research was done by James Bruno.

are intended instead as aids to be used in quantifying as many aspects of a problem as possible to make choices clearer.

PLANNING

"Planning" has many different meanings. Numerous definitions of the term have been offered, many of which are summarized by Millett (1947) and Dror (1963).

At the UCLA Center for the Study of Evaluation, we view evaluation generally as the process of providing appropriate information for decision making. A "planning evaluation" in our framework deals with the presentation of information about programs that have not yet been implemented. We define planning evaluation or *planning* as the selection, analysis, and presentation of data to facilitate optimum choices from among alternative future courses of action.

With planning thus defined, what then are educational planning decisions and in which of these are we primarily interested? Planning decisions relate to various kinds of problems at many levels of society. Lave and Kyle (1968), for example, have distinguished four major divisions of educational planning: *macroscopic planning*, dealing with the allocation of resources to education as opposed to other public sectors of the economy; *educational policy planning*, dealing with the allocation of resources within education relative to broad alternative educational objectives; *internal educational planning*, dealing with choices among alternative methods, media, and technologies; and *operational planning*, dealing with choices among alternative methods of implementing educational decisions and of monitoring the operation and management of the educational system.

In this paper we are concerned primarily with the third category, although admittedly it is impossible to consider that level of educational planning without at times also discussing the total question of education policy or the manner in which selected alternatives will be implemented. Indeed, the obvious need for continuity among the four levels of educational policy necessitates some overlap. Some of the national studies that will be mentioned later in a discussion of operations research are actually related to questions of educational policy. Similarly, program evaluation review technique (PERT) and the critical path method are of prime importance in educational implementation and operations.

What may now be obvious to the reader is that our prime frame of reference in considering techniques appropriate for educational planning is the school administrator at the individual school or district level.

The questions we will attempt to answer relate to the evaluation of the process of choosing among alternative programs to be introduced into the school or educational system. This choosing process includes the comparison of existing programs to an alternative program, specified or unspecified. The procedures (or methodologies) appropriate for evaluating educational planning are the various systems techniques, including systems analysis, planning-programming-budgeting systems, and operations research.

Systems Approaches

Since the word *system* will appear frequently in the following discussion, it might be useful to define this term. According to Webster, a *system* is "an assemblage of objects united by some form of regular interaction or interdependence as an organic or organized whole." Webster is defining what should be recognized as a simple system, since the key word in this definition is "regular." Educational systems, on the other hand, are extremely complex and "irregular." Hence, the application of systems thinking to problems in education is more difficult than its application to regular systems.

The essence of a systems approach is the construction of and operation within a *model*. By model we mean an idealization of the situation appropriate to a problem. A model may take the form of a computer program, a game, or even a set of questionnaires. The introduction of the model provides a precise structure and terminology for communication between the model builder and informed participants. Moreover, the existence of a model helps the decision makers to reach judgments; and it enables the experts on whom they depend to use feedback in revising earlier judgments.

FIVE ELEMENTS OF A SYSTEMS APPROACH

The development of a model, though of central importance, is only one of five *elements of a systems approach*. These are: (1) the objectives, (2) the alternatives, (3) the costs, (4) the model (or models), and (5) the decision rule.

Among the first tasks of a systems researcher is to try to determine what *objectives* the decision maker is or should be trying to attain, and to measure the extent they are actually being attained. The specification of objectives provides a basis for comparing alternative strategies. For example, one objective might be to raise the reading level of emotionally

disturbed third graders. *Alternatives*, or alternative strategies, are different ways of attaining an objective. Thus, possible alternatives for improving the reading ability of emotionally disturbed third graders might include special reading clinics, programmed reading materials, tutoring, and psychological counseling.

Each alternative has *costs*, and the selection of that alternative implies the acceptance of the associated costs. Dollar expenditures are costs, and so are deferred expenditures (though ordinarily less costly than the same dollar expenditures at present). Not all costs are represented by dollars, however. Time is also a cost. The amount of time expended by students, for example, is not a free commodity and must be considered in an analysis.

Models are the most essential element of a systems approach. They represent schematically the cause-and-effect relationship that defines the situation under study. In addition to the examples given earlier, models may be mathematical equations, computer problems, verbal descriptions of the situation, or even physical objects. In systems study, the role of the model is to predict the costs and the degree of attainment of specified objectives associated with each alternative.

The final element of a systems approach is a *decision rule*, which is used to establish priorities by ranking the alternatives. The decision rule provides a means of weighing each alternative's costs against its effectiveness, so that the relative desirability of all the alternatives can be measured. This fifth element is commonly referred to as a "criterion," but we have refrained from using this term because of its specialized meaning in education and educational research.

Following these five steps, the systems researcher should be able to determine the objectives, select or devise the alternatives, determine the costs of each alternative, develop a representative model whereby he can predict the extent each alternative will achieve the specified objective, and arrange the alternatives in order of preference.

Unfortunately, the analysis is seldom this tidy. This is especially true in education where the objectives involve social values and are not easily agreed on or measurable. Furthermore, the range of alternatives in education has not been expanded beyond the ordinary and traditional, perhaps partly because of the lack of systems analytic thinking. Moreover, accounting systems in education seldom, if ever, consider outcomes along with costs and thus are often unable to provide adequate cost data. The lack of sufficient systematic research on the nature of education and on potential input-output models makes predictions from such models

wrought with uncertainty. Moreover, decision rules have simply not been specified.

IMPORTANCE OF ITERATION

With such difficulties as these, the key to a successful systems study is iteration. Systems studies, especially in social settings, require a continuous cycle of formulating the problem, selecting objectives, designing alternatives, collecting data, building models, weighing costs against effectiveness, questioning assumptions, and re-examining objectives. This iterative process, as described by E. S. Quade (1966), is depicted in figure 1.

Some of the steps listed in this iteration process are very difficult to perform in education. For example, how does one go about weighing costs against effectiveness in planning educational systems? Or how would one test the sensitivity of these measures? Probably the single most important problem in applying systems analytic approaches in educational planning is the development of a comprehensive and adequate set of defined measures of systems output.

There is nothing really new about the systems approach. It has been used, implicity, by educational administrators since early times. The need for considering costs relative to performance is not novel.

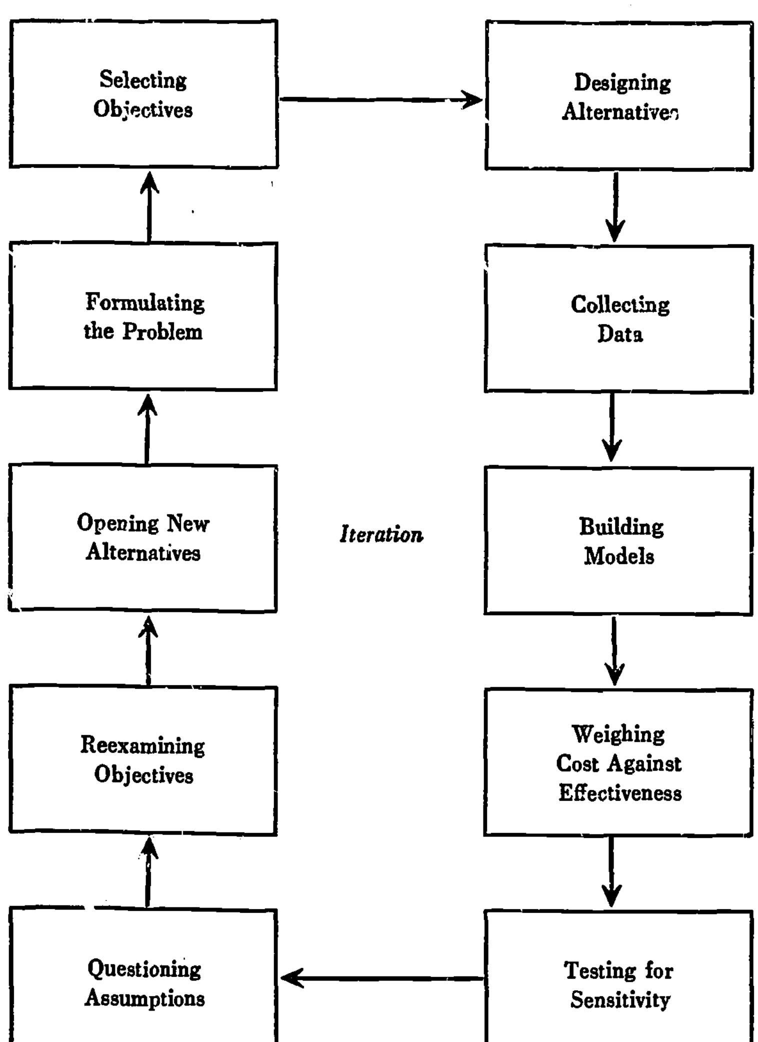
"What may be novel, though, is that this sort of analysis is an attempt to look at the entire problem systematically with emphasis on explicitness, on quantification, and on the recognition of uncertainty. Also novel are the schemes or models used to explore the consequences of various choices" (Quade 1966, p. 11).

KINDS OF SYSTEMS APPROACHES

Considerable confusion and some disagreement exist on the differences among the various systems techniques. Several of the techniques are referred to by some observers as being interchangeable; for example, operations research and systems analysis are believed by some to be only different terms for the same process. We disagree. Some use systems analysis as the generic term describing all approaches. We disagree. Some avoid the whole issue by coining their own terms. We doubt that this is a particularly useful approach.

On this we are clear: Prior to World War II, British leaders sought the advice of prominent scientists regarding the deployment of radar. Subsequently, scientists worked on other defense projects, including an analysis of particular military operations. These groups came to be

FIGURE 1
KEY TO ANALYSIS



SOURCE: Quade (1966, p. 10)

known as *operations research* groups. As the problems addressed by these scientists increased in complexity, as the techniques were applied to still broader problems, and as researchers found it necessary to supplement the operations techniques by drawing from other academic disciplines, new descriptions of the work evolved. Work on these broader, more complex kinds of problems increasingly came to be known as *systems analysis.*

Generally, all these techniques, including operations research and systems analysis, are considered as cases or types falling within the general rubric that we will call the *systems approach.* All such approaches include the five elements previously described.

Differences among the various systems approaches are primarily of emphasis. Systems analysis, for example, generally emphasizes the problems of designing objectives and seeking alternatives. Problems under this classification usually are not as elaborately defined, and the models and techniques emphasized are generally less rigorous. However, systems analysis, like planning-programming-budgeting systems, can also be applied to structured problems having well-defined objectives and involving a range of alternative solutions.

PPBS is much more concerned with the cost element of a systems approach.

Opera:'ons research characteristically considers immediate problems and techniques emphasized are generally less rigorous. However, systems, Operations research has been most often concerned with the development and use of models.

It is not possible to completely summarize all the knowledge on each of these topics in the pages available. Thus we have set as our task the presentation of only enough material to introduce each of the techniques and to indicate some possible applications. Succeeding chapters will examine operations research, PPBS, systems analysis, and other systems approaches. Limitations of the techniques and some future implications and speculations will be discussed in the final two chapters.

24

Operations Research

OPERATIONS research, as we have noted, is a systems approach. It is generally accepted that operations research originated in the military, some of its earliest applications being in that field. These early applications were generally rigorous and had few uncertainties, short time-horizons, and clear-cut objectives. Of the five major elements of a systems approach, three were relatively well determined: the objectives, the costs, and the decision rule.

Business and industry have been particularly amenable to operations-research applications. The objectives of a business or of its subfunctions are relatively easy to define, making possible the introduction of accounting systems to provide cost data related to programs and subprograms. Moreover, difficult-to-measure social or public costs and benefits have never been of significant concern in most parts of the private sector of the economy.

Furthermore, the decision rule in business and industry has been rel-

atively clear-cut—minimizing costs in production, maximizing earnings from sales, or some specific solution in between these two. Finally, in business and industry a large number of alternatives are possible and are easily specified. Different input mixes (combinations of raw materials) might be used in the production of the given product, different quantities of various products might be produced, and some products might even be eliminated or their quotas might be modified for various sales markets.

The distinctions between operations research and other systems approaches such as systems analysis are by no means clear. This is partly due to the continued use of these terms by many individuals who do not have a clear understanding of the approaches. Some of the ambiguity may be justifiable, since clear-cut differences between methods have begun to fade away. Operations researchers in recent years have expanded their interests to include "social" variables and less easily quantifiable models. Thus, the dominions of operations research and systems analysis have increasingly converged.

Operations research might be considered a method of obtaining optimum solutions to problems in which relationships are specified and criteria for evaluating effectiveness are known. Operations research summarizes alternatives into mathematical expressions and models. It then identifies the set of alternatives that maximizes or minimizes the desired criterion for evaluating effectiveness. Systems analysis and PPBS, on the other hand, are techniques that might result in feasible solutions and that have their greatest applications in defining the problem, establishing the need, and recommending a list of alternatives along with criteria that could be used for evaluating effectiveness.

Depending on the individual and his interests, definitions of operations research can vary and can include or exclude particular techniques. "Gaming," for example, in its most highly quantified form, is referred to by some as operations research. However, games can also be applied to social interactions that are relatively difficult to quantify. For this reason, we will consider gaming in a later chapter. As a further example, some consider network analysis an operations-research technique; we do not, and will consider it in a later chapter also.

Another emphasis in operations research is the concern for problems of a recurring nature. The cost of performing an operations analysis necessitates its application to problems having some degree of generalizability. Thus, in the development of operations-research techniques, certain types of problems have been emphasized and specific techniques

have been designated for their solution. One operations-research text, for example, considers the following types of problems: inventory control problems, diet or "mixture" problems (perhaps you recall simple forms of such problems from your Algebra I class), transportation problems, warehouse problems, caterer problems, production-smoothing problems, and waiting-line or flow problems (di Roccaferrera 1964).

Operations-Research Techniques

The models or mathematical techniques used in the solution of these problems have come to be recognized as the basic operations-research techniques. Some of the major ones are linear programming, dynamic programming, Leontief input-output analysis, and queuing theory (Churchman et al. 1957). We will briefly discuss each of these techniques before considering their applications.

Linear programming is a technique for optimally allocating limited resources to satisfy competing demands under conditions of known and fixed limitations or constraints. Optimality is measured in terms of either dollars of cost or units of time. The term "linear" implies a straight-line relationship between the variables.

Problems in allocation arise when several activities are to be performed, but when constraints on either the amounts of resources or on the way they can be allocated make it difficult or impossible to perform each separate activity in the most effective way. The problem is to determine how the resources should be allocated to the activities to maximize total system effectiveness.

In the mathematical solution to the problem, the limitations are described as the "constraint set." The purpose of the constraint set is to place upper and lower bounds on the resources available to the system. This is done by placing a limit on the consumption of these resources by any particular activity in the system.

A second major element in the mathematical solution is the "objective function," which insures that optimum allocation is achieved—that the specified criterion of effectiveness is achieved at its maximum or minimum value, consistent with all the constraints imposed on the system. The question to be answered is whether the optimum allocation takes place at minimum cost, maximum benefits, or minimum time, etc. Essentially, the objective function enables the selection of one solution from among an infinite set of feasible solutions that maximize or minimize the particular criterion for effectiveness. This one solution is known as

an "optimum" solution because it is the best solution consistent with the constraint set.

Several types of problems have been found amenable to solution by linear programming. One such problem, in which the resources and activities are each specified, is to allocate the resources to the activities in such a way as to maximize some measure of effectiveness (e.g., outputs) or to minimize some measure of ineffectiveness (e.g., financial costs).

Dynamic programming is a mathematical technique useful in solving problems that have many interrelated stages, often measured in time intervals. It takes into account the effect that changes in previous stages have on the present stage, and thus reflects the dynamic character of many administrative processes. Where the assumption of a "static" system is not appropriate, dynamic programming might be chosen instead of its predecessor, linear programming.

Application of dynamic programming is more difficult, however, than that of linear programming, mainly because there is no standard mathematical formulation for the application of dynamic programming to a problem. The particular equations used in dynamic programming must be tailored to each specific situation. A certain amount of ingenuity and insight into the general structure of dynamic-programming problems is therefore required.

Leontief input-output analysis was developed prior to linear programming. It consists of a given number of simultaneous linear equations with the same number of unknowns or variables. Since there are as many unknowns as equations, there is a single unique solution. Programming applications, in contrast, have a number of possible solutions.

The basis of this system is the development of a "transactions table" that conveniently displays the relationships between economic outputs and inputs for individual sectors of the system. The input-output table has rows showing production sectors and columns showing demand sectors. By varying the demand in one of the demand sectors, the required amount of production to meet this change in demand can be calculated. The table could also be used to determine the effect of an incremental change in one output on related incremental changes in others. To aid in these computations, Leontief developed a procedure for determining various coefficients or "technical values."

Queuing theory is concerned with the waiting-line problem. Queues or waiting lines often form where people or things require some speci-

fied service whose facilities are limited. The time factor is always involved.

Application of queuing theory requires information concerning the rate of arrivals at the servicing station or stations, the time required to provide each unit of service, and the method of selecting arriving units to be served. In general, the problem takes one of two forms: Either the facilities to meet certain specified needs must be determined, or the facilities are fixed and the problem is to determine the proper scheduling and distribution of arriving units.

The ultimate goal in such problems is to achieve an economic balance between the cost of service and the cost of waiting for that service. Queuing theory, while not directly solving the problem, provides the information essential for solution by predicting various characteristics of the waiting line, such as average waiting time. This information is needed by the educational planner in reaching an effective decision.

Some problems that are otherwise amenable to analysis by operations-research methods cannot be adequately or realistically solved by these analytical models. For help in solving these problems, other operations-research techniques have been devised.

Computer simulation models, for instance, are attempts at describing a system quantitatively to provide answers to certain types of questions. Simulation models examine only those variables considered appropriate for answering the questions at hand. Using specified rules that define the interrelationships among the variables, the models can be used to determine the numerically specified outcomes that might result from each of several alternative strategies. Simulation does not produce the optimum answer; it narrows the alternatives and provides a basis for making choices.

Monte Carlo methods are sometimes used in simulation models to approximate unpredictable aspects of the situation under study. Essentially, the Monte Carlo method is a simulation technique whereby statistical distribution functions are created by the use of random numbers. The method uses statistical sampling techniques to obtain a probabilistic approximation of some variable or relationship in a mathematical problem. Recently, this technique has been used to solve problems in such diversified fields as the social sciences, the military, and industry and business.

A Markov chain describes a special type of probabilistic behavior. It is a procedure used to describe and predict the behavior or state of a

system at some future time based on the system's present status and on some transition probability figures (or flow rates). As a management tool, the Markov process has been used in the last few years mainly in marketing to examine and predict the brand loyalty of consumers.

APPLICATIONS

Several conditions have limited the application of operations research to broad educational systems. One is a lack of adequate research knowledge about the objectives of the educational system, as well as a lack of adequate ways of measuring these objectives. Another is a lack of knowledge of the input-output relationships necessary in education for producing models. Still another serious limitation is the lack of adequate cost data for alternative strategies. To sidestep these problems, the early applications of operations-research models to education have concerned themselves with relatively finite, easily identifiable subsystems of the larger educational system.

Summarizing these applications is difficult for two major reasons. First, with operations research just beginning to be applied to education, much work in the area remains at the conceptual and proposal levels. We are all familiar with the typical report of many operations researchers that chastises the educator for not being more systematic. Usually, however, the report goes on to say that a model has been presented that has not been applied, but that "easily could have been applied had the data been available." Lack of data is precisely one of the reasons why educators have not applied O.R. techniques more frequently.

Second, many reports of O.R. applications exist only in mimeographed form and have not been widely distributed. Instead of being a comprehensive listing, therefore, the studies cited below can only be considered examples of work in this field. Although the applications will be grouped by the various O.R. techniques, related applications of two or more techniques will sometimes be discussed together.

LINEAR PROGRAMMING

Problems of assignment and distribution are two of the most important applications of linear programming. Educational planners can use the technique to assign personnel or equipment to various activities. For example, linear programming might be applied to an analysis of a school's transportation system. Considering the number of school buses,

garage locations, and student pickups and deliveries, the objective would be to minimize such things as financial costs and student time spent en-route. Other problems readily suggest themselves, including assignment of faculty members to various activities in terms of their relative strengths or weaknesses, and allocations of classrooms and other facilities within an institution.

In one application, investigators at the RAND Corporation used an assignment model to propose a solution to a problem of bus routing and assignment of students. The objective of this study was to relieve over-crowding in a certain number of schools in a district by filling 2,370 vacancies in 55 other schools that were not filled to capacity. Costs were to be kept to a minimum and no child was to be transported more than 15 miles (Shapley et al. 1966).

In a similar study, Clarke and Surkis (1968) developed a system that considered school desegregation as a multiple product distribution problem. Given various characteristics of the situation, the solution was to devise a plan of assignment that achieved the desired ethnic composition at each school, set a maximum travel time for any given student, and minimized total daily student travel time. A similar study was done in San Francisco (Lefkowitz and D'Epsopo 1967). O'Brien (1967) also developed a model for assigning pupils to schools.

Linear-programming techniques have also been used for scheduling students. The earlier scheduling programs, such as CLASS (*This Is CLASS* 1962), were limited to assigning students to prespecified master schedules of classes and sections. More sophisticated systems have been developed that are capable of generating a master schedule of classes as well (Bush and Mosteller 1955, Cogswell et al. 1966, and Oakford et al. 1967).

School finance is another area where linear-programming techniques have been applied. Models were developed to determine optimum strategies for allocating state resources, to determine a logical and internally consistent salary schedule at minimum district cost, and to consider various patterns of subsidies for college students (Bruno 1968 and Hoenock 1969). A related problem, but requiring a different technique, was the subject of an Office of Education study that examined the impact of undergraduate student aid from federal sources (Froomkin 1969).

A study by Bowles (1967), based on the principle of constrained maximization, concerned the problem of allocating resources to education within an economy. Both costs and benefits of various educational programs were explicitly considered.

LEONTIEF INPUT-OUTPUT ANALYSIS

Leontief input-output analysis represents a simple way of classifying the interrelationships among economic data and provides a mechanism for quantitatively estimating incremental changes. The technique therefore appears to have value for educational administrators concerned with budget analysis and budget planning.

Stone (1966) depicted the flow of students through an educational system by means of an input-output matrix. Each level of education was considered as the input for the next level. The major purpose of the study was to determine what the future demand for education implies for the present.

We are unaware of any other completed applications of the Leontief input-output analysis. However, an application being attempted at UCLA deserves brief comment. Aikin and Hoffenberg (Alkin *Framework* 1969) are using an actual accounting basis to allocate certain school district line-item costs (e.g., maintenance) to other budget line-items. On the basis of these allocations, a matrix similar to a Leontief transaction table will be developed. The analysis assumes, in effect, that because of the interrelationships among budget line-items, the outputs of some items can be regarded as inputs to other line-items. The computation of coefficients and the performance of an input-output analysis may provide information on incremental budget costs. From the procedure, insights might therefore be gained into the total costs resulting from any management decision to employ a specific alternative strategy.

DYNAMIC PROGRAMMING

At this time, the applications of dynamic programming are mostly potential. Among the problems potentially solvable by this method are the timing of equipment replacement and the smoothing of production levels to meet variable demands (Lindsay 1963). In education, decisions concerning the location and size of future schools and the repair and replacement of school equipment might be amenable to analysis using dynamic programming.

QUEUING THEORY

Many segments of education seem appropriate for analysis by means of queuing theory. School business applications might include the scheduling of secretarial or telephone answering time. Queuing theory also could be applied to areas more closely related to the educational program, such as the scheduling of books or even student registration. Other

possible applications include ascertaining the number of counselors needed in a school, determining span of control, and any other problems involving service time and waiting time in a district.

Several pilot studies by Gold demonstrate potential applications of queuing theory to education. In one study, Gold (1968) employed the technique to determine how many counselors should be made available by a city college, given the desire to use counselors' time as efficiently as possible and to minimize students' waiting time. He developed models describing the distribution of student arrival times in the college's guidance center and the distribution of service time.

From the models, Gold derived the following information: average time an arrival spends in the system, average number of units in the system, probability that all servers are free, and probability that all servers are busy. On the basis of this data computed for various levels of counselor service, Gold was able to determine the optimum number of counselors for the described conditions.

In another study, Gold determined the optimum number of switchboard trunk-lines and operators for a city college. Gaynor (1969), reporting on computer systems, noted that Van Dusseldorf and his colleagues at Iowa also have applied queuing techniques to education.

Although the applications of queuing theory to education may seem pedestrian, they point out clearly that relatively simple applications offer the greatest benefits at this time. By applying queuing-theory techniques to the business-like activities of education, those activities could be greatly systematized.

COMPUTER SIMULATION MODELS

One kind of computer simulation employs statistical techniques to produce a descriptive simulation model. The technique most often employed is regression analysis or one of the other multivariate correlational techniques.

Literally hundreds of studies might be cited as exemplary of this type. Many investigators have developed models to "explain" expenditures for education. In these instances they have examined total expenditures as the dependent variable explained by the model, and have obtained high levels of explained variance (Alkin 1966, Hirsch and Marcus 1966, James et al. 1963, and Miner 1963).

Regression analysis also has been used to examine student achievement outcome measures (Burkhead 1967, Mayeske 1969, and Thomas 1963). The difficulty of using regression analysis is the inability of assigning a

causal significance. All that can be said is that a high value of one variable usually occurs with a high value of another; statements then can be made about the amount of explained variance. Studies of this type are useful as first-cut reductions of data. Their results may provide clues to interesting relationships that might be considered in future phases of a study. The impact of the Coleman study on future computer simulations of education should be noted in this regard.

Many applications of computer simulations to education have been "macro" models dealing with state or national systems. Most of these have been manpower-flow models, often employing Markov approaches. The emphasis on state and national systems may be partly due to the relative ease of gaining data for such units as opposed to an individual school or school district. To some extent, however, this emphasis may also result from the greater interests that the investigators, many of whom are economists, have in problems at this level.

MARKOV CHAIN

Studies in several countries have used Markovian models to project enrollment and flows of personnel through a system. Tore Thonstad (1967), for instance, developed a model of the Norwegian educational system. Its purpose was to study the long-range implications of educational policies to help in forecasting university needs. Enrollment projection models have also been developed for the British and German educational systems (Fitzsimmons 1966 and Stone 1965).

Another example of a Markovian demographic-flow model is the DYNAMOD model developed by the U.S. Office of Education. It is intended to predict the increases in students and teachers for the nation as a whole in the next decade. Based on an analysis of over 140 population groups, the model projects educational demand and analyzes policy alternatives (Zabrowski et al. 1968). Two other similar applications are a model for projecting movements of personnel through a system (Merck 1965) and a model dealing with numbers of students in each level or class of the educational system (Durstine 1969).

Two studies dealt with the generation of doctoral graduates and their feedback into higher education (Bolt 1963 and Reisman and Taft 1969). Bruno (1969) applied Markovian analysis to the evaluation of instructional programs. The study demonstrated how Markovian analysis can be used as a valuable supplement to standard statistical procedures in assessing gains in achievement resulting from instruction.

OTHER APPLICATIONS

Turning from the state and national levels to individual schools and school systems, it is at the university level where the greatest achievements in the use of planning technologies have occurred. Wilson (1969) has prepared an excellent conceptual framework for the consideration of computer-simulation techniques in higher education planning. The University of California has employed computer-simulation models for its planning purposes (Keller 1967). Judy (1968) developed a mathematical model for the University of Toronto that had two main objectives: (1) to precisely describe the university system and (2) to predict resource implications of various plans. Another model descriptive of a university was developed by Koenig and Keeney (1969).

Among the applications of planning models to elementary and secondary education, the work of Sisson (1969) is particularly noteworthy. A model developed by Sisson determines the required number of teachers and noncertificated employees for each year of the planning period, and specifies other line-item costs. These data are generated using the beginning enrollment and certain ratios that reflect district-stipulated policies. At the University of Pennsylvania, work is under way to begin to hypothesize an input-output relationship for education in the form of a thermodynamic model. Intended to relate resource allocation to achievement, the model is being developed with the cooperation of the Philadelphia School District (Sisson 1967).

Several applications specifically useful at the school district level can be cited. One model that we have already discussed was developed by the U.S. Office of Education for planning the location and size of urban schools. The value of the model, when computerized, derives from its ability to examine many alternatives in the size, number, and location of schools, including different physical facilities and grade spans (O'Brien 1967).

Griffin and Schmitt (1967), in a paper delivered at the 1966 AERA convention, discussed a Monte Carlo application to the projection of school enrollment. Uxer (1967) developed a model for locating sites for area vocational schools.

Bruno (1969) has applied Monte Carlo simulation techniques to testing the financial feasibility of an incentive increment program in a school district. The method was used to calculate school district costs as a function of time and to determine the peak cost. Suggestions were also made on use of the technique in long-range school district financial planning.

In the realm of more mundane applications of computer simulation, two studies related to the recruitment and use of substitute teachers. One study (Haussman and Rath 1965) considered alternative strategies that might be employed in the daily recruitment of substitutes. An objective of the study was to devise a policy that would maximize the number of positions filled relative to the associated administrative costs.

In the other study, Bruno (1969) proposed the replacement of current substitute teacher programs in large urban school districts by a permanent pool of substitute teachers, a certain percentage of whom would be high-potential, noncredentialed individuals from minority groups. By means of a Monte Carlo simulation analysis, the size of the substitute teacher pool needed to meet the various design criteria was determined. The criteria considered were minimum costs, maintenance of present service levels, and financial break-even.

25

Planning-Programming-Budgeting Systems

We now consider another major system analytic technique, planning-programming-budgeting systems (PPBS). The term PPBS is far more confusing than it need be. Stated simply, PPBS is concerned with developing budgeting systems (BS) by program category (PBS) to facilitate long-range planning (PPBS). William Gorham has described PPBS more elaborately as follows:

> The Planning-Programming-Budgeting System is a framework for planning—a way of organizing information and analysis in a systematic fashion so that the consequences of particular choices can be seen as clearly as possible. It attempts to do three things:
>
> 1. To display information about the functioning of actual governmental programs so that it is possible to see easily what portion of Federal resources is being allocated to particular purposes, what is being accomplished by the programs, and how much they cost;
> 2. To analyze the costs of alternative methods of achieving particular

objectives so that it is possible to rank the alternatives in terms of their relative costs;

3. To evaluate the benefits of achieving objectives as comprehensively and quantitatively as possible in order to facilitate the setting of priorities among objectives. (1967, p. 6)

An *NEA Research Bulletin* provided the following description of PPBS:

> A PPB system is an integrated system to provide executive and legislative officials with better and more information for planning programs and for making choices among optional ways funds can be devoted to achieving governmental objectives. It aids the decision-making processes in helping find new ways, through analysis and evaluation of public programs, of doing the public business faster, better, and less expensively. (1968, p. 112)

It is clear that all five major elements of a systems approach—objectives, alternatives, costs, models, and a decision rule—are present in PPBS. Most attention, however, is paid to the objectives, the costs, and the benefits. The development of models is of lesser concern unless one considers the budgeting system itself as a model.

History

Schick (1966) has described perhaps most completely the history of budget reform that led to the development of PPBS. He points out that there have been three distinct budgetary periods in recent American governmental history, each having a different emphasis. The first of these was the period of "control" in which the emphasis was on the objects of expenditure. The purpose of this control was to make certain that public officials handled funds honestly.

The period of control was followed by what Schick describes as the period of "management." It was during this period that such terms as program budgeting and performance budgeting came into vogue. The management theorists emphasized the use of the budget as a management tool.

The third stage, which we have now entered, is described by Schick as the period of "planning." Here the emphasis is on a series of decision-making steps with planning as the key focus. He is quick to point out, however, that even this planning stage "strives for a multi-purpose budget system that gives adequate and necessary attention to the control and management areas. . . ." (pp. 245-6).

The traditional school budget was designed primarily to serve the control function. In this budget, proposed expenditures are classified according to such functions as administration, instruction, operation of

the plant, fixed charges, and capital outlay. Although this budget helps to insure that the organization's financial resources will be spent in an orderly and planned fashion, it does not relate proposed expenditures to what is to be achieved. Consequently, it is rather difficult for decision makers to add, delete, or alter expenditures to make them consistent with changes in educational objectives. Programs are likely to be instituted without an adequate appropriation of funds, or proposed expenditures may be decreased without a proportionate adjustment in objectives.

The deficiencies of traditional school budgeting systems were summarized well in a report by the Philadelphia Board of Education:

> These difficulties may be summarized as: first, no long-range planning; second, no process for establishing priorities; third, line-item budgeting which minimizes the ability to manage and does not identify resources with specific educational programs; fourth, no attempt to show least cost alternatives; fifth, lack of management information for responding to public questions and for making sound judgments; sixth, absence of program measurement in terms of costs and benefits; and seventh, lack of financial authority commensurate with responsibility and the consequent lack of accountability. (1969, p. 8)

PPBS, on the other hand, describes the various objectives of educational programs and classifies the proposed expenditures according to each objective. It relates the proposed objectives, programs, and expenditures to one another. Use of PPBS enables decision makers, therefore, to consider all aspects of the budget together rather than separately, thus encouraging a decision-making process that facilitates maximum attainment of the established goals.

There are numerous differences, as reported by Hartley, between the traditional budget and the program budget. The major differences can be considered in three categories: content, structure, and time horizon (Hartley 1969).

The differences in content are due primarily to differences in the completeness with which the two budgets describe a proposed plan. Whereas the traditional budget deals primarily with objective categories, the program budgeting system fully describes the fiscal resources required to implement the budget plan.

There are two distinct types of differences in structure between the traditional budget and the program budget. Differences exist both in the presentation of various cost categories and in the way each cost category is related to the objectives and activities of the school district.

Finally, the third major difference is that the program budget plans for

a longer time period than the traditional budget. The traditional budget is a single-year plan; the program budget is a multiyear plan.

From these differences, it is apparent that the program budget and the traditional budget differ fundamentally in their approaches to the task of planning. We may conclude, therefore, that, although it is possible to cross-walk between the two types of budgets, the program budget is not simply a rearrangement of the traditional budget.

DIFFICULTIES IN APPLYING PPBS

A salient feature of PPBS as a systems approach is that it is, as Cleland and King have stated (1968), "output oriented." This characteristic of PPBS is in contrast to the present "input-oriented" budgeting system. An important first step in applying the process, then, is the selection of objectives. Since these objectives must be couched in terms of output, and since they must be capable of evaluation, we are forced to state them in measurable or quantifiable terms. Unfortunately, not a great deal of progress has been made toward precisely stating the objectives of educational systems (Alkin *Use* 1969 and Popham 1969). Here, then, is the chief impediment to the application of PPBS to education.

The technical problems facing program accounting systems are relatively easy to resolve. The main problems to date have been caused not so much by lack of technical proficiency as by lack of adequate definition of "program." Thus the development of PPB systems is impeded more by educational problems than by accounting problems.

One result of the recent major conference on program accounting for public schools was the highlighting of a number of technical issues to be resolved. Lindman (*Introduction* 1968) pointed out that various levels of government are providing increased support to local public school programs and will expect more information concerning the programs they support. Thus a program accounting system at the local level must anticipate the fiscal information needs of these supporting governmental agencies.

In addition to the problems already noted, application of PPBS involves the following issues: (1) Which major dimensions or classification codes should be uniform throughout the United States? (2) Which dimension(s) should be selected for appropriation and control purposes in the annual budget? (3) Should there be a breakdown by grade level in the type-of-school dimensions? (4) Should the functional category of instruction, including principals' salaries, be retained? (5) Should the category of "fixed charges" be continued? (6) To what extent should the

accounting system reflect the categorically aided programs? (7) Should the general fund accounting format include provisions for the handling of total amounts spent for student activities and food services? (8) Should the unit cost by curriculum areas or specific subjects be determined by accounting procedures or by a cost analysis method? (9) Should more emphasis be placed on accounting by location? (10) How should indirect costs be handled in a program accounting system? (Lipot 1968)

Applications

Most of the works that might be thought of as properly falling in the category of "applications of PPBS to education" are of two types. First, a great amount of literature describes the nature and present uses of PPBS in education, making great promises about the new rationality to result from its use, and exhorting educators to "get with it." Comprising the second type are the attempts by various school districts and state and federal governments to introduce the beginnings of a PPB system. The former instances are not really applications. The latter attempts are generally not sufficiently developed that we can refer to them with any degree of reliability. Thus, quite explicably, this section will be brief.

Within the first category, which we refer to as "a general call to arms" or "rally around the flag, fellows," are to be found a number of generally descriptive documents, several of them quite good. Among the general discussions of PPBS, the best reference we have found is the book edited by Lyden and Miller (1968). Concerning education specifically, the book by Hartley (1968) offers a comprehensive definition and description of PPBS as well as of its practical applications to education. It describes some of the PPBS development activities under way in school districts. Some excellent descriptive materials were prepared by the RAND Corporation as technical reports in fulfillment of a contract with Operation PEP (Dei Rossi 1968, Haggart 1968 and 1969). Other general materials not as complete are mentioned in the fine annotated bibliography prepared by the Association of School Business Officials (1968).

Although PPBS had been used earlier by the Defense Department, the main impetus to serious consideration of PPBS as a methodology came in a presidential directive in 1965 (Executive Office of the President 1965). President Johnson directed that all federal agencies adopt the PPBS approach used by the Department of Defense. Since then, the Office of Education has been converting to PPBS. Attempts also have been made at

viewing local educational expenditures, aggregated at the national level, in terms of PPBS (Hirsch 1965).

Many state legislatures have made extensive efforts toward implementing PPBS in the public schools. William Curtis, research project director for the Association of School Business Officials, has stated that 80 per cent of the state legislatures have either mandated or considered the introduction of PPBS into the schools (*Education Recaps* 1969). At the forefront is California, which is in the second year of a long-range program to bring about a statewide adoption of a PPB system for all California school districts. Peat, Marwick, Mitchell, and Co. (1969), which holds the California contract, has prepared the conceptual design for PPBS in California and is attempting to incorporate the system in some other states.

At the local level, a number of school districts have developed budgeting systems that they refer to as PPBS. In our view, it is still too early to make judgments about these systems. Among the early users of the PPB system were the school districts of Memphis, Tennessee (Stimbert 1965); Philadelphia, Pennsylvania (Brown 1968); and Chicago, Illinois (Hill 1965). Others are Baltimore, Maryland (Furno 1967); St. Louis, Missouri (Lawson 1968); Los Angeles, California (McMullen 1968); and Dade County, Florida (Linton 1968).

Besides the Association of School Business Officials, other organizations have attempted to develop PPB systems. Foremost among these is the Midwestern States Educational Information Project (1968).

Other attempts to develop PPB systems have been made by the state-local finance project at George Washington University (1968) and by a committee of the California Association of Public School Business Officials (Lindman *Introduction* 1968). Other excellent references in the general area of PPBS are made by Bradley (1968) and McCullough (1966).

Many individuals also have attempted to develop PPB systems or to develop a backup program accounting system based on various premises. Based on the premise that a multidimensional accounting system was needed, Lindman (1968) and Hagen (1968) each developed a three-dimensional budget format. Sherwood (1965) examined the cost implications of specific state requirements. Wickert (1968) developed a program-budgeting system based on California statutory requirements. He assumed that the mandatory and permissive regulations of the California education code sufficiently defined the objectives of the system and the

nature of the programs. Fitzsimmons (1966) also attempted to develop PPB systems for education.

Training materials have been developed for the PPBS Clinic of the AASA National Academy for School Executives (Knezevich *Systems, Translating,* and *Meaning* 1969).

Under the general area of applications, we would be remiss in not mentioning two additional references. An excellent article by Aaron Wildavsky (1966) should be required reading for anyone contemplating the use of systems approaches and particularly PPBS. Wildavsky comments that program budgeting at the highest levels has become so entangled in the structure of the political system that it has left pure efficiency far behind. He notes that program budgeting is a system analytic approach that is an integral part of system politics.

Another interesting and provocative paper was prepared by Marvin Hoffenberg (1969), who considered the organizational implications of introducing PPBS into education.

26

Systems Analysis

A technique coming into greater use in education that might be considered part of the systems approach is systems analysis. We define systems analysis as the set of activities or procedures that addresses itself to the important issue of design. By design we mean the delineation of a plan for using personnel, money, and materials to achieve a desired goal.

Identification of important issues and determination of needs are critical functions of systems analysis. Since issues often can be presented more effectively by an insightful analyst with pencil and paper than by a complex computer model whose assumptions are totally or partially hidden, systems analysis is primarily an art. Only when a final design is presented do the sophisticated mathematical techniques of operations research come into consideration. In short, systems analysis does not rely on the use of computers or applied mathematics or on the quantification of all variables in a given situation; rather, it involves the application of

the scientific method to complex problems, with emphasis on objectivity and empirical or logical testing and retesting of hypotheses.

Instead of working in an area where the problem is already defined, the systems analyst seeks to define the problem and to offer the decision maker a range of alternative solutions representing different blends of costs and benefits. Broadly speaking, therefore, any orderly, systematic investigation designed to help a decision maker to identify a preferred course of action from a set of possible alternatives might be termed a systems analysis.

Systems analysis may rely heavily on other disciplines such as psychology, sociology, and economics. Thus it might be considered as a mechanism or framework for bringing these diverse disciplines to bear on a particular problem in some rational and systematic manner with the purpose of improving some effectiveness criterion. As Cleland and King have written:

> Systems analysis is a combination of a set of tools, philosophies and techniques which is designed to facilitate choices between alternatives in a fashion which maximizes the effectiveness of resources available to the organization. (1968, p. 6)

Although systems analysis per se might not be required in the solution of all problems, its general underlying principle applies to all decision making. Alain Enthoven, one of those primarily responsible for the introduction of systems-analysis procedures to the Defense Department, described the nature of systems analysis as follows:

> What is systems analysis? ... I would describe the art ... as a reasoned approach to problems of decision. Some have defined it as "quantitative common sense." Alternatively, it is the application of methods of quantitative economic analysis and scientific method, in the broadest sense, to the problems of choice. . . . It is a systematic attempt to provide decision makers with a full, accurate and meaningful summary of the information relevant to clearly defined issues and alternatives. (1966, p. 161)

Unlike the other quantitative techniques of the systems approach, systems analysis generally concerns itself with long-range rather than short-range implications. These long-range or extended-time-horizon studies make it essential to consider all outside forces—political, social, and economic—that might affect the system.

A problem facing systems-analysis studies is that optimization in the rigorous, mathematical sense is impossible because many variables are nonquantifiable. Usually, therefore, not only one but a whole set of feasible solutions useful in meeting the design criteria must be proposed.

Studies of the systems-analysis type also work with vague or ill-defined measures to evaluate effectiveness. This latter aspect is probably the most important reason why optimization in systems studies is impossible.

In summary, systems analysis has basically six characteristics that distinguish it from other techniques of the systems approach. These are (1) a longer time horizon, (2) uncertainty of effectiveness measures, (3) less rigorous mathematical formulations, (4) heavy emphasis on interdisciplinary approaches, (5) a set of feasible solutions rather than one optimum solution, and (6) inclusion of nonquantifiable variables.

Numerous systems-analysis studies* of the military have been completed. A bibliography of selected RAND Corporation (1967) publications concerning military systems-analysis is available. The bibliography contains an index and the abstracts of about 260 unclassified publications on various aspects of systems analysis. An excellent textbook on the use of systems analysis in policy planning, with specific applications to the defense area, was prepared by Quade and Boucher (1968).

Apart from the military, an example of the use of systems analysis is the California Waste Management Study by Aero-Jet General Corporation (1965). In this report, systems analysis is suggested for use in solving the overall problem of waste management in California.

The application of systems-analysis techniques to education is not a recent development. A decade ago McKean and Kershaw, two RAND economists, proposed using systems analysis for improving educational systems. They wrote:

> After having studied the educational process, the problems of measurement, and the data that are becoming available, we conclude that it will soon be feasible to make comparisons of this sort that can help administrators and others choose improved educational systems. It will be necessary first, however, for more work to be done toward estimating the "input-output relationships" in education—that is, the relationships between school characteristics (and other inputs) and the products. In this report, the kind of analysis that offers hope of estimating the input-output relationships is described, and the sort of formal comparison to which we refer is illustrated. (1959, p. iii)

A project applying systems analysis to the design of schools was completed by the System Development Corporation. The study attempted to analyze and design new organizational patterns that enable school sys-

* Unfortunately, the term "systems analysis" has sometimes been used to refer to various other techniques of the systems approach. In many lists of references, studies that inaccurately refer to these other techniques as systems analysis are cited under the general heading of systems analysis. In this paper studies are cited where we think they belong—according to the actual techniques referred to, not their titles.

tems to more readily adapt to new technology and methodologies (Egbert and Cogswell 1963).

In another study, Levine (1969) performed a systems analysis that related manpower needs at various educational levels to the overall growth of an educational plant. In his analysis, such factors as the amount of resources that can be devoted to building an educational plant are considered to determine the most effective policy for providing the required manpower. The study sought to avoid a policy that would supply more individuals than could be accommodated by the economy over a reasonable period of time.

Some of the more recent applications of systems analysis to education deal primarily with problems of improving the quality and the level of education in underdeveloped countries. In these studies trade-offs between various educational media and instructional systems are analyzed. The General Learning Corporation (1968), for example, studied various media costs under various instructional environments and recommended possible ways of saving costs in media utilization, application of new technology, and educational system organization. In a similar study, the planning of education in Columbia was undertaken and possible alternative methods of raising the level and quality of education were studied (Carpenter and Haggart 1967).

In some cases, conceptual models for system analytic studies have been proposed for studying specific educational problems. Alkin (1968) has proposed a model, based on a systems-analysis framework, for the evaluation of instructional programs. A more quantitative approach to applying systems analysis to instructional evaluation was proposed by Mood (1967).

Use of systems analysis in the evaluation and design of school districts has been studied only recently. Barro, Brunner, and Scheurer (1969) have developed an evaluation design for the San Jose Unified School District Compensatory Education Program. The use of systems analysis for defining and evaluating alternatives in school districts has been proposed by Barro (1968).

Finally, one of the most comprehensive sets of references on systems analysis and planning in higher education was compiled by Hufner (1968).

27

Other System Analytic Techniques

SEVERAL system analytic techniques useful in educational planning are less well known than operations research, PPBS, and systems analysis. Included in this group are simulations, operational gaming, the Delphi technique, the program evaluation review technique (PERT), and the critical path method (CPM).

SIMULATIONS

Since simulations are simply models built to fulfill one of the steps in the systems approach, it may seem redundant to discuss them. However, we feel such a discussion to be appropriate because of the large number and variety of simulations that are relatively nonquantitative and therefore might not be considered models by the relatively unsophisticated reader.

Basically, a simulation model is an attempt to simulate or portray a situation in the real world. To the extent the model approximates the

relevant characteristics of the real situation, the modeler is able to reach tentative conclusions about the situation. Simulation as a form of model building is worthwhile in education because social experimentation is often virtually impossible.

Simulation models may be composed of sets of mathematical equations. For example, many of the models required in employing operations-research techniques are simulation models using mathematical expressions. Simulation models need not be mathematical, however. Physical simulation models, for example, could be used in the study of urban redevelopment, where stages of the transformation of a city could be displayed with the aid of a miniature mockup (Helmer and Rescher 1959).

Operational Gaming

One variation of simulations is operational gaming. In gaming, human subjects simulate the roles of real-world decision makers in a laboratory setting. Since education and particularly educational administration deal with human interactions, this type of simulation is of special interest. Goodman (1969) of the System Development Corporation is developing a game dealing with educational planning and decision making. The game concerns a problem of school integration and is geared primarily to the school board member as a participant. By allowing participants to play roles as representatives of various community interest-groups, the game enables them to better understand the political implications of potential decisions.

Abt and his associates (1967) and Coleman and his colleagues (1966) have developed several games that might be useful as models in systems analyses. Another study used inputs provided by several rounds of expert judgment as the basis for an educational-planning game. Although the planning level related primarily to national policy decisions, the technique might be appropriate at the school district level as well (Adelson et al. 1967).

Frequently, games have been developed primarily for student instructional purposes that might be equally useful as devices for simulating educational-planning decisions. Several examples readily come to mind. The Madison training materials developed by the University Council for Educational Administration could conceivably be used in this way (Gaynor 1969). Another example is the Simulated Evaluation Exercise developed by the Center for the Study of Evaluation at UCLA (Alkin et al. 1969). Finally, Robert Ohm's (1966) computer simulation model,

developed primarily for instructing educational administrators, also might have planning applications.

A technique closely related to model building, though not in itself a form of it, is "scenario writing." Olaf Helmer describes it as follows:

> Scenario writing involves a constructive use of imagination. It aims at describing some aspect of the future; but instead of building up a picture of unrestrained fiction, or even of constructing a utopian invention which the author considers highly desirable, an operations-analytical scenario starts with the present state of the world and shows how, step by step, a future state might evolve in a plausible fashion out of the present one. . . .
>
> The connection with model building is at least threefold. Firstly, the process of writing a scenario may be looked upon as a primitive one-man mode of simulation, inasmuch as the author forces himself to go through the experiment examining in his mind a plausible developmental change of events. Secondly, a useful heuristic device in setting up a formal model concerning a future situation may consist in beginning to write several scenarios, because these can be of great help in discerning the decision relationships among the elements of the situation and in eliminating negligible irrelevancies. Thirdly, once a simulation model has been constructed . . . the records of repeated runs of the model constitute a systematic source of scenarios and thus afford methodical sampling of future contingencies. (1965, pp. 9-10)

We know of no example of the use of this technique in educational planning, but expect that it might be applicable.

DELPHI TECHNIQUE

The Delphi method has been increasingly used in systems studies for obtaining certain kinds of data. Delphi is a procedure for structuring judgments about future events that were elicited from experts (Helmer and Rescher 1959). In the procedure, judgments are solicited through a series of questionnaires, are combined, and then are fed back to the participants along with additional information obtained as a part of their response. The participants remain anonymous.

Through the process it is hoped that assumptions and projections will converge without the undue influence of more influential members. Helmer, Hoffenberg, and Gordon (1963) reported the technique has been used in about 50 studies at RAND and in the military and in industry. They noted it had often been found to produce "convergent estimates and rich content."

Two RAND researchers reporting on the results of the use of Delphi noted that it produced convergence and that for material whose accuracy

could be checked, group response improved in accuracy with iteration (Helmer and Dalkey 1963).

In one large-scale experiment with several international panels of respondents, the Delphi technique was used to arrive at long-range contingency forecasts of the state of the world in twenty-five years (Gordon and Helmer 1966).

The first application of the technique to education was in 1966 when it was employed as a potential planning aid for educational policy makers. An impressive group of international participants from many disciplines selected the educational innovations they considered appropriate for changing education. They received feedback on the amount of consensus and dissensus and participated in succeeding rounds where they were allowed to modify their views. The panel was then allowed to assign budget allocations. This continued until some degree of convergence was achieved (Adelson et al. 1967).

The Delphi technique recently has been used in several states to elicit "needs assessment" views from constituent groups as part of the Title III evaluation. In addition, Hammond and Stufflebeam (1968) employed the technique in working with vocational educators to determine the most appropriate criteria for judging proposed program evaluations.

Researchers at the Center for the Study of Evaluation at UCLA are studying the use of the Delphi technique as a planning device for ascertaining the objectives of an elementary school. This study is associated with a larger project concerned with developing an elementary school evaluation system (Alkin *Framework* 1969).

PERT AND CPM

Two other techniques that might be used for educational planning purposes are the program evaluation review technique (PERT) and the critical path method (CPM). PERT and CPM are two of the least mathematical of all the systems techniques for educational planning.

PERT was developed for controlling the costs and schedules of the Polaris missile and submarine system. At about the same time the Navy was developing PERT, the Du Pont Company introduced CPM.

The use of PERT involves a number of steps, chief of which is the development of a network, or graphic representation, that depicts the individual tasks necessary for completing a project. The time required to complete each activity in the project must be estimated, and the activities need to be sequenced in the network. Next, the critical path, or the sequence of connected activities that forms the longest path in duration

through the network, must be determined. With PERT, managers can plan the sequence of events necessary for completing the project in the most efficient way possible.

PERT also provides a planning device to monitor and evaluate the process. One of the primary functions of PERT is to determine the probability of meeting specified deadlines. It identifies the activities that are most likely to be bottlenecks and that must receive the greatest attention if the process is to remain on schedule. Also, PERT is capable of evaluating the effect of a contemplated shift of resources from less critical activities to activities identified as probable bottlenecks.

Although CPM and PERT are alike because they both are essentially network types of analysis, CPM originally differed from PERT by including cost factors as well as time and by employing some mathematical procedures for finding lowest cost. Now, however, aspects of cost are also being related to and used in PERT.

The leading advocate of the application of PERT to education is Desmond Cook at Ohio State University. A monograph prepared by Cook (1966) describes the technique and its pertinent applications to education.

One of the earliest educational applications we are aware of is described in a 1963 doctoral dissertation (Benson). It delineated a complete program for using PERT in planning and opening a new junior college. Gold (1968) reports the technique has been used in scheduling the construction of at least three other junior colleges. PERT also was reported to be of use in coordinating the activities related to the expansion of staff, curriculum, and buildings at Cuyahoga Community College (Cook 1966).

Kapfer (1968) has developed an institutional strategy based on PERT that is intended to assist teachers in establishing and following through on a sequence of activities leading to greater individualization of instruction.

There are undoubtedly many other applications of PERT to education. Its greatest impact apparently has been in the management of educational research and evaluation studies (Case 1969). Many federal agencies, for example, are encouraging recipients of large research grants to apply PERT to their activities.

We expect that the trend toward increasing use of PERT will continue, although we would caution against its use simply to accommodate a current fad. In many projects that are relatively small and do not have definite starting and ending points, the use of PERT may be unwarranted and lead to unnecessary costs.

28

Limitations

THERE are two general limitations governing the use of systems techniques. First, a systems study does not *make* decisions, nor is it capable of doing so. And second, a systems study is only as good as the data it uses.

Systems approaches are, at best, simply aids in quantifying the measurable aspects of a problem in order to delimit the alternatives. Fisher described this overall limitation on systems studies as follows:

> In practically no case should it be assumed that the results of systems ... [studies] ... will make the decision. The really interesting problems are just too difficult, and there are too many intangible (e.g., political, psychological, and sociological) considerations that cannot be taken into account in the analytical process, especially in a quantitative sense. (1965, p. 59)

Most of the difficulties associated with the use of systems approaches involve the adequacy of the data used. It is important that the systems researcher understand the nature of the data so that he can know to what

extent the results obtained from them might be taken seriously. The most exotic computer model cannot produce meaningful results if the data on which they are based are untenable. "GIGO," the motto of computer programmers, accents this point—"Garbage In, Garbage Out."

In the succeeding paragraphs, we will discuss several dimensions of the problem of basing systems studies on adequate data. These six dimensions will be classified as: (1) problems of infancy, (2) problems of judgment, (3) problems of measuring objectives, (4) problems of predicting the future, (5) problems of incomplete inquiry, and (6) problems of handling data.

Problems of Infancy

Applications of systems techniques to education are in the infancy stage. It is thus understandable that analyses frequently are performed that are unsophisticated and show great naivete. For example, the difficulties of defining effectiveness in education often lead systems researchers to approach their analysis from the cost side. The decision rule they employ might be stated as follows: "Assume equal outcomes from each of the alternatives and select the alternative that is of least cost." Skeptical educators, of course, treat these conclusions with disdain.

However, we must be patient with the progress of infants, since they must learn to crawl before they can run. We need only to remember how long it has taken to get reasonable results in other fields to recognize that progress will take a similar length of time in education. After many years of attempting to apply systems techniques to the military, one RAND scientist observed:

> Though analysis is a powerful tool, specific analyses vary greatly in quality. Some are little more than trash. But we need to discriminate, rather than to reject analysis *in toto*. At the present time there is some risk that we will do the latter. In an address some years ago Secretary Enthoven observed: "My general impression is that the art of systems analysis is in about the same stage now as medicine during the latter half of the 19th century; that is, it has just reached the point at which it can do more good than harm." That was a frank and realistic, if somewhat pessimistic, assessment of the state of the art. Scientifically speaking, there are numerous blind spots in medicine. Yet, most of us ultimately are inclined to accept the doctor's diagnosis if not his advice. Quite plainly at the present time Congress and the public are having second thoughts regarding how much trust to put in systems analysis. No doubt it is necessary to develop a greater ability to discriminate. Nonetheless, I suggest that policy will benefit substantially from the analysts' diagnoses. (U.S. Senate Subcommittee on National Security and International Operations 1968)

Thus it was not at all disturbing and perhaps even a little flattering when Alice Rivlin, reminding us of the great progress we have made in education in a very short time, said:

> After two years of applying PPBS to educational programs at HEW, I can report that we have only systematized our ignorance. We have a much clearer idea than we did before of just what it is we don't know and what we need to know. (1968)

Problems of Judgment

It is important to recognize that a systems study deals with the analysis of choices so as to recommend or suggest policies, whereas scientific research has as its goals understanding and prediction. Systems approaches, therefore, do not maintain the standard of scientific research. In using them, the analyst is sometimes forced by the nature or urgency of a problem to substitute intuition or hunches for verifiable knowledge. Human judgment is used in designing the analyses, and judgment and hunches permeate all analyses.

However, in spite of the "softness" of systems techniques, educational decisions must be made and are being made. The techniques offer both a rational approach to providing information for decision making and "a scientific method free of the human attributes of preconceived ideas and partisan bias" (Quade 1965).

Problems of Measuring Objectives

Quade has said, "In military comparisons, measures of effectiveness are at best reasonably satisfactory approximations for indicating the attainment of such vaguely defined objectives as deterrence or victory. Sometimes the best that can be done is to find measures that point in the right direction" (Quade and Boucher 1968, p. 24). Without question, the same is true in education.

Greater precision is needed in the specification of objectives and in the determination of performance indicators that measure those objectives. Not all areas generally considered as the outputs and functions of the school are at this time measurable. These facts, however, should not cause educators to dismiss blatantly all attempts at measuring the outputs of systems and to speak hazily of "the moral and aesthetic realms of education." There are *other systems existent* whose outputs are as difficult to measure as education. Pointing in the right direction is at least a reasonable first step.

Problems of Predicting the Future

Most attempts at developing models for use in systems studies rely on data of past occurrences. We do not mean to be critical of these studies, for such data are a reasonable starting point. But it should be clearly understood that the models will be valid only if the relationships between input and output are the same in the future as in the past—that is, if the future can be adequately predicted from the past. Clearly, there is no satisfactory way to determine future events.

Work under way at several institutions might provide some more adequate means of forecasting the future and of including such forecasts in the models generated for systems study. The Institute for the Study of the Future in Danbury, Connecticut, and the Educational Policy Research Centers at Syracuse University and at the Stanford Research Institute are all considering ways of forecasting the future. The results of their work may be useful in improving the validity of educational models. Perhaps further refinements of such procedures as the Delphi method and gaming will ultimately provide better estimates of the future impact of alternatives.

Problems of Incomplete Inquiry

The costs of time and money place sharp limits on how far an inquiry can be carried. Choices that at one time were correct may become outdated and goals originally established may become antiquated. Moreover, even without limitations of time and money, it may be impossible in an analysis to treat all the potentially relevant considerations.

In thinking of an educational system, irrespective of the number of variables that might actually be included, one can always imagine various political, sociological, and psychological factors that might not have been considered. Although the analyst might attempt to apply his own judgment and intuition to some of these variables so as to include them in the study, it is always necessary to recognize that the decision maker will rightly insist on applying his own judgment as well. Therefore, instead of considering all the data, a systems study can only attempt to indicate some potential decisions on the basis of the more easily quantified data. In doing so, it frees the decision maker to devote his time to the more complex and less quantifiable questions.

Problems of Handling Data

Since systems approaches involve the gathering and consideration of

such a broad range of information, another problem has to do with the handling and use of data. As data increase, so does the possibility that errors will be made in processing and interpreting the data. We wish only to emphasize that care should be taken to insure the data's accuracy. Obviously, it would be foolish to conclude that decisions are best made with no information at all.

29

Speculations

New computer capabilities and the growing number of qualified personnel are major reasons why the use of systems approaches in education should increase in the years ahead. Systems approaches will be applied increasingly to a wide variety of routine problems in the local schools. With continued educational research and development, they will also be applied to more difficult educational problems.

Increased Use

The number of direct applications of systems procedures to school district planning problems should increase enormously in the coming years. The efforts of large corporations, universities, regional educational laboratories, research and development centers, and systems research divisions in many of our large school districts should insure a steady increase in systems research applications to educational planning.

Advances in mathematical programming, decision theory, simulation, etc., will continue and will exploit the growing hardware and software capabilities of computers. Two RAND scientists have stated:

> New areas will be opened up to management science, especially those dealing with social and public issues and programs. These challenges will add to the breadth of training required of management scientists, not only in the new fields of application, but also in new approaches to problem-solving. Social welfare functions, social costs, and the so-called externalities of private activity will have to be increasingly considered in building new models, in data collection and in analysis. (Denardo and Geisler 1967, p. 9)

From this and similar statements in the literature, we conclude that the merging of sociological and psychological research methodologies with systems research seems to be assured. Present neglect of these variables in most systems models constitutes one of their severest limitations.

More and more educators are being trained in the use of systems approaches. According to one educator, "School administrators in late 1967 were on the threshold of awareness of concepts, vehicles and procedures related to the systems approach (Knezevich *Systems* 1969). This awareness has resulted largely from increased emphasis on programs for training educational planners in the use of operations research, systems analysis, and PPBS.

Training in the use of systems techniques seems to be occurring on at least four levels. First, graduate schools of education are beginning to offer courses in these management-science areas either by themselves or in conjunction with schools of business administration. Second, many regional laboratories and research and development centers are conducting research on the use of these techniques in educational planning and in the schools. Third, private corporations such as the System Development Corporation are beginning to form professional groups of management scientists specifically concerned with educational planning.

Finally, large inservice programs, specifically designed for training school administrators in the use of modern management techniques, are being instituted in many states. An example of this is California's Operation PEP, an inservice program for preparing educational planners. The philosophy behind the new PEP program basically summarizes the rationales behind all the current efforts to apply systems techniques to the schools.

Further information about the use of these techniques is being communicated to educators through professional journals in the fields of education, business administration, and economics. Increasing numbers of

articles in these journals have reported on actual research into the applications of systems approaches to school district problems. In addition, books have recently been published and many are about to be published that summarize for the practicing school administrator what has been accomplished by the use of these techniques in educational planning (Pfeiffer 1968).

Areas of Application

There are at least two areas in education where increased applications of systems approaches should become evident in the years ahead. First, we have already begun to witness the application of operations-research models to some of the "micro" problems in education—those related to the business functions of schools, supply questions, and various suboptimization problems. An increasing array of educational problems will be recognized for which operations-research techniques might provide solutions.

The second and ultimately the most valuable application of systems techniques to education will be their use in selecting among alternative processes for achieving specified educational objectives. In the past, several impediments have hindered systems applications of this type. These are (1) the lack of specificity in the designation of educational outcomes and the lack of adequate measures of these outcome dimensions (objectives); (2) the failure to specify financial costs by educational program (cost); and (3) the lack of sufficient research into the nature of the interrelationships among inputs, process characteristics, and outputs. Recently, however, encouraging signs have pointed to the possibility of solving these problems.

First, progress is being made in specifying educational objectives and in developing measures of these objectives.

For some time it has been widely recognized that the statements of objectives formulated by school districts are so ambiguous as to be nearly worthless for the purpose of quantitative optimization studies. The specification of objectives for classrooms or for specific instructional programs often are not much better. Although for years attempts have been made to specify behavioral objectives for specific instructional programs, most attempts have been specifically single-purpose in construction. In many such instances the objectives have lacked clarity and in practically all instances no attempt was made to disseminate these stated objectives to other segments of the educational community.

The Center for the Study of Evaluation at UCLA recently has begun

a major project that offers promise of providing considerable assistance in this area. The center has established an Instructional Objectives Exchange whereby statements of objectives and related test items are being collected from various school districts and other educational agencies. In addition, the center is attempting to develop comprehensive pools of these objectives and test items in several specific subject fields (Alkin *Framework* 1969).

With respect to the specification of financial costs by program, there are also encouraging first steps. The development and planned introduction of related accounting systems in some states were noted in an earlier section. These systems include the necessity for specifying programs.

Finally, we feel that the stock of educational research knowledge has been increasing at a significant rate. The associated needs for quantitative specification of problems and for developing mathematical formulations that describe the relationships among variables are being met more easily because of the number of research studies presently taking place. Project TALENT, the Coleman study, and other studies that have used the Coleman data certainly form the groundwork for any discussion of attempts to establish a secure data base for optimization studies in education. In addition, a vast array of other studies are under way, including those at USOE's National Center for Educational Statistics and at the Educational Testing Service under the direction of Scarvia Anderson.

Hopefully, the progress being made in each of these areas will lead very soon to an increase in the amount of data available and in the number of educational-decision situations that are subjected to analyses through the use of system analytic techniques.

The Systems Researcher in School Districts

Most likely, as experience grows in the use of systems approaches, many school districts will hire systems researchers to conduct analyses. Educational management consultant firms, composed mainly of mathematicians, economists, and physical scientists, will be formed to aid school district planners. One RAND scientist, in discussing the use of management consultant firms in other areas of the economy, stated:

> Bringing diverse skills and ingenious new analytical techniques to bear on your problems, the new kinds of management consultant firms are still constrained to understand the problem and to define objectives, to search diligently for all available data, to make searching tests of their assumptions, and to weigh carefully the criteria with which they must evaluate their conclusions and recommendations. (Collbohm 1957, p. 6).

We anticipate that school districts will devote increasing attention to developing inhouse systems-research capabilities. Research departments of school districts typically have been composed of individuals trained in educational and psychological research. Often the directors of research in school districts have been frustrated by the routine demands of administrators who have seen little value in pure or applied research activities per se. This gap between the decision-oriented administrators and the researchers, who are unwilling to be satisfied with anything less than experimental conditions, has failed to aid in bringing about educational change.

New educational training programs that emphasize systems approaches should provide capable staff for school districts. In addition, we would envisage cooperation between school district researchers and private consultants. For example, after the system-design and problem-definition phases are completed by the district, outside consultants might be brought in to help build the necessary models.

Bibliography

Abt, C. C. "Education Is Child's Play." In *Inventing Education for the Future*, edited by W. Z. Hirsch. San Francisco: Chandler Publishing Company, 1967.

Adelson, M. "The Systems Approach: A Perspective." *SDC Magazine*, no. 10, 1966, entire issue.

Adelson, M.; Alkin, M. C.; Carey, C.; and Helmer, O. "Planning Education for the Future: Comments on a Pilot Study." *American Behavioral Scientist*, no. 7, 1967, entire issue.

Aero-Jet General Corporation. *California Waste Management Study: A Report to the State of California Department of Public Health*, August 1965.

Alkin, M. C. *Financing Junior Colleges in California: A Critical Analysis of the State Support Program.* Sacramento, California: State Department of Education, 1966.

Alkin, M. C. *A Framework for Evaluation Study.* Los Angeles: University of California, Center for the Study of Evaluation, 1 August 1969.

Alkin, M. C. *Towards an Evaluation Model: A Systems Approach.* Report No. 43. Los Angeles: University of California, Center for the Study of Evaluation, February 1968.

Alkin, M. C. "The Use of Quantitative Methods as an Aid to Decision Making in Educational Administration." Paper presented at the annual conference of the American Educational Research Association. Los Angeles: 5-8 February 1969.

Alkin, M. C.; Bentzen, M. M.; and Grigsby, J. E. *CSE Simulated Evaluation Exercise: Instruction Guide.* Report No. 49. Los Angeles: University of California, Center for the Study of Evaluation, 1969.

Alkin, M. C.; Bentzen, M. M.; and Grigsby, J. E. *CSE Simulated Evaluation Exercise: Materials Supplement.* Report No. 50. Los Angeles: University of California, Center for the Study of Evaluation, 1969.

Association of School Business Officials, Research Corporation. *Program Planning-Budgeting-Evaluation System Design: An Annotated Bibliography.* Chicago: ASBO Research Corporation, December 1968.

Barro, S. M. "The School District as a System: A Means for Defining Educational Programs and Alternatives." Santa Monica, California: The RAND Corporation, D-17233 SMS, 17 June 1968.

Benson, E. M. "Time and Sequence Analysis of Critical Steps in the Establishment of California Public Junior Colleges." Unpublished Ed.D. dissertation, University of California, 1963, p. 74.

Bolt, R. H. "Doctoral Feedback into Higher Education." *Science*, no. 3672, 1963, pp. 918-928.

Bowles, S. S. "The Efficient Allocation of Resources in Education." *Quarterly Journal of Economics*, no. 2, 1967.

Bradley, B. D. "Program Budgeting." Santa Monica, California: The RAND Corporation, P-3859, May 1968.

Brown, O. S. "The Philadelphia School District Approach to Program Accounting." In *Approaches to Program Accounting for Public Schools*, edited by E. L. Lindman. Report No. 34. Los Angeles: University of California, Center for the Study of Evaluation, November 1968.

Bruno, J. E. "A Monte Carlo Analysis for Determining Optimal Size of Substitute Teacher Pools." Mimeographed. Los Angeles: University of California, Graduate School of Education, 1969.

Bruno, J. E. "Use of Mathematical Programming Models to Optimize Various Objectives of Foundation-Type State Support Programs." Unpublished Ph.D. dissertation, University of California, Graduate School of Education, 1968.

Bruno, J. E. "Uses of Markovian Analysis in Conjunction with Standard Statistical Techniques for the Evaluation of Instruction." Mimeographed. Los Angeles: University of California, Graduate School of Education, 1969.

Bruno, J. E. "Uses of Monte Carlo Techniques in Long-Range School District Planning." Paper presented at the annual conference of the American Educational Research Association. Los Angeles: February 1969.

Burkhead, J. *Input and Output in Large City High Schools.* Syracuse, N.Y.: Syracuse University Press, 1967.

Bush, R. R., and Mosteller, F. *Stochastic Models for Learning.* New York: John Wiley and Sons, Inc., 1955.

Carpenter, M. C., and Haggart, S. A. "Planning and Public Education in Columbia, with Examples of Alternatives." Santa Monica, California: The RAND Corporation, D-15917 AID, 1967.

Case, C. M. *The Application of PERT to Large-Scale Educational Research and Evaluation Studies.* Princeton, N.J.: Educational Testing Service, RM-69-14, May 1969.

Churchman, C. W.; Ackoff, R. L.; and Arnoff, E. L. *Introduction to Operations Research.* New York: John Wiley and Sons, Inc., 1957.

Clarke, S., and Surkis, J. "An Operations Research Approach to Racial Desegregation of School Systems." *Socio-Economic Planning Sciences* 1 (1968): 259-272.

Cleland, D. L, and King, W. R. *Systems Analysis and Project Management.* New York: McGraw-Hill, Inc., 1968.

Cogswell, J. F.; Egbert, R. L.; Marsh, D. G.; and Yett, F. A. "A Computer Simulation Vehicle for Educational Systems." *Computer Concepts and Educational Administration.* Iowa City: Iowa Educational Administration Center, University of Iowa, 1966.

Coleman, J. S. "In Defense of Games." In *Simulation Games and Learning Behavior*, edited by J. S. Coleman, S. Babcock, and E. O. Shields. *American Behavioral Scientist*, no. 2, 1966, entire issue.

Collbohm, F. R. "Scientific Aids to Decision-Making—A Perspective." Santa Monica, California: The RAND Corporation, P-1032, January 1957.

Cook, D. L. "Applications of PERT to Education." Paper prepared for Operation PEP: A statewide project to prepare educational planners for California, February 1968.

Cook, D. L. *Program Evaluation and Review Technique: Applications in Education.* Washington, D.C.: U.S. Office of Education, Cooperative Research Monograph No. 17 (OE-12024), 1966.

Dei Rossi, J .A. "Comparing the Program Budget and the Traditional Budget." Santa Monica, California: The RAND Corporation, D-17155-1-SMS, June 1968.

Denardo, E. V., and Geisler, M. "Management Science Frontiers: 1970-80." Santa Monica, California: The RAND Corporation, P-3612, June 1967.

di Roccaferrera, G. M. F. *Operations Research Models for Business and Industry.* Cincinnati: South-Western Publishing Company, 1964.

Dror, Y. "The Planning Process: A Facet Design." *International Review of Administrative Sciences*, no. 1, 1963, pp. 44-58.

Durstine, R. M. "In Quest of Useful Models for Educational Systems." *Socio-Economic Planning Sciences* 2 (1969): 417-437.

Education Recaps, vol. 8, no. 10, p. 7. (citing *Education Summary*, 15 June 1969, p. 8.)

Egbert, R. L., and Cogswell, J. F. "Systems Analysis and Design in Schools." Santa Monica, California: System Development Corporation, SP-1141, AD-400-370, 6 March 1963.

Eidell, T. L., and Piele, P. *A Bibliography of Selected Documents on Planning, Programming, Budgeting Systems.* Eugene, Oregon: ERIC Clearinghouse on Educational Administration, University of Oregon, BR-5-0217-1, 1 May 1968.

Enthoven, A. C. "Systems Analysis and the Navy." In *A Modern Design for Defense Decisions: A McNamara-Hitch-Enthoven Anthology*, edited by S. A. Tucker. Washington, D.C.: Industrial College of the Armed Forces, 1966, pp. 161-184.

Executive Office of the President, Bureau of the Budget. "Planning-Programming-Budgeting." Bulletin No. 66-3. 12 October 1965.

Fisher, G. H. "The Role of Cost-Utility Analysis in Program Budgeting." In *Program Budgeting*, edited by D. Novick. Washington, D.C.: U.S. Government Printing Office, 1965.

Fitzsimmons, W. B. "A Model for a Public School Program Budget." Unpublished Ed.D. dissertation, Colorado State College, 1966.

Freytag, H. L. "Systems Analysis Approaches to Research on German Education." *Socio-Economic Planning Sciences* 2 (1969): 263-267.

Froomkin, J. "Cost-Effectiveness and Cost-Benefit Analysis of Educational Programs." *Socio-Economic Planning Sciences* 2 (1969): 381-388.

Furno, O. F. "Program Budgeting and School Quality." *AEDS Monitor* 9 (April 1967): 13-16.

Gaynor, A. Summary Report of the UCEA Task Force meeting on "The Development and Use of Computer-Based Systems in Educational Administration." Columbus, Ohio: University Council on Educational Administration, Ohio State University, 18 April 1969, pp. 3-4.

General Learning Corporation, Educational Services Division. *Cost Study of Educational Media Systems and Their Equipment Components*, vol. 2. Final Report to the U.S. Office of Education. Washington, D.C.: May 1968.

Gold, B. K. "Quantitative Methods for Administrative Decision Making in Junior Colleges." Unpublished Ed.D. dissertation, University of California, Graduate School of Education, 1968.

Goodman, R. F. "SDC School System: Crisis Simulation." Santa Monica, California: System Development Corporation, September 1969.

Gordon, T., and Helmer, O. "Report on a Long-Range Forecasting Study." In *Social Technology* by O. Helmer. New York: Basic Books, Inc., 1966.

Gorham, W. "Notes of a Practitioner." *The Public Interest*, no. 8, 1967, pp. 4-8.

Griffin, M., and Schmitt, J. "A Monte Carlo Model for the Prediction of School Enrollments." Paper presented at the annual conference of the American Educational Research Association. Chicago: February 1967.

Hagen, J. W. "A Three-Dimensional Program Budget for Public Schools." Unpublished Ed.D. dissertation. Los Angeles: University of California, Graduate School of Education, 1968.

Haggart, S. A. "Evaluating Alternatives in Educational Planning." Santa Monica, California: The RAND Corporation, D-17238-SMS, June 1968.

Haggart, S. A. "Program Budgeting and Educational Planning: An Overview for Operation PEP." Santa Monica, California: The RAND Corporation, D-1723[illegible]-SMS, June 1968.

Haggart, S. A., and Carpenter, M. B. "Program Budgeting as an Analytical Tool for School District Planning." Santa Monica, California: The RAND Corporation, P-4031, February 1969.

Hammond, R. L., and Stufflebeam, D. L. "Conference To Plan an Evaluation of State-Administered Programs for the Handicapped." Report to the U.S.

Office of Education, Bureau of Education of the Handicapped. Columbus, Ohio: Evaluation Center, Ohio State University, August 1968.

Hartley, H. J. *Educational Planning-Programming-Budgeting: A Systems Approach.* Englewood Cliffs, N.J.: Prentice-Hall Inc., 1968.

Hartley, H. J. "Limitations of Systems Analysis." *Phi Delta Kappan,* no. 9, 1969, pp. 515-519.

Haussman, R. D., and Rath, G. J. "Automated Teacher Assignment—A GPSS Simulation." *Journal of Educational Data Processing,* no. 3, 1965, pp. 103-108.

Helmer, O. *Social Technology.* Santa Monica, California: The RAND Corporation, P-3063, February 1965.

Helmer, O., and Dalkey, N. C. "An Experimental Application of the Delphi Method to the Use of Experts." "*Management Sciences,* no. 3, 1963, pp. 458-467.

Helmer, O.: Hoffenberg, M.: and Gordon, T. J. "Technology and the Study of the City." Report commissioned by the Task Force on Economic Growth and Opportunity. Washington, D.C.: Chamber of Commerce of the United States, 1968.

Helmer, O., and Rescher, N. "On the Epistemology of the Inexact Sciences." *Management Sciences,* no. 1, 1959, pp. 25-52.

Hill, D. W. "Progress Report on Program Budgeting in Chicago." In *Trends in Financing Public Education: The Proceedings of the Eighth National Conference on School Finance.* Washington, D.C.: National Education Association, April 1965, pp. 191-193.

Hirsch, W. Z. "Education in the Program Budget." In *Program Budgeting,* edited by D. Novick. Washington, D.C.: U. S. Government Printing Office, 1965.

Hirsch, W. Z., and Marcus, M. J. "Some Benefit-Cost Considerations of Universal Junior College Education." *National Tax Journal,* no. 1, 1966, pp. 48-57.

Hoenock, S. A. "Efficient Allocation of Subsidies to College Students." *Socio-Economic Planning Sciences* 2 (1969) :503-512.

Hoffenberg, M. "Program Budgeting in Education: Some Organizational Implications." In *Strategies of Educational Planning: Proceedings of the Second Annual Conference on the Economics of Education,* edited by R. H. P. Kraft. Tallahassee, Florida: Educational Systems Development Center, Florida State University, 1969.

Hufner, K. "Economics of Higher Education and Educational Planning—A Bibliography." *Socio-Economic Planning Sciences* 2 (1968): 25-101.

James, H. T.; Thomas, J. A.; and Dyck, H. "Wealth, Expenditure and Decision-Making for Education." Cooperative Research Project No. 1241. Stanford, California: Stanford University, School of Education, 1963.

Judy, R. W. *Systems Analysis for Efficient Resource Allocation in Higher Education.* Toronto, Canada: University of Toronto, Institute for the Quantitative Analysis of Social and Economic Policy, November 1968.

Kapfer, P. G. "An Instructional Management Strategy for Individualized Learning." *Phi Delta Kappan*, no. 5, 1968, pp. 260-263.

Keller, J. W. "The Use of Models in University Decision Making." Report issued by the office of the president. Berkeley, California: University of California, November 1967.

Knezevich, S. J. "The Meaning and Substance of the Acronym PPBS." American Association of School Administrators, National Academy for School Executives, 1969.

Knezevich, S. J. "Probing the Planning and Programming Dimensions of PPBS." American Association of School Administrators, National Academy for School Executives, 1969.

Knezevich, S. J. "The Systems Approach to School Administration: Some Perceptions on the State of the Art in 1967." *Socio-Economic Planning Sciences* 2 (1969): 127-134.

Knezevich, S. J. "Translating Objectives into Operational Programs and Defining Alternatives in Education." American Association of School Administrators, National Academy for School Executives, 1969.

Koenig, H. E., and Keeney, M. G. "A Prototype Planning and Resource Allocation Program for Higher Education." *Socio-Economic Planning Sciences* 2 (1969): 201-215.

Lave, R. E., and Kyle, D. W. "The Application of Systems Analysis to Educational Planning." *Comparative Education Review*, no. 1, 1968, pp. 39-56.

Lawson, S. "The St. Louis Approach to Program Accounting." In *Approaches to Program Accounting for Public Schools*, edited by E. L. Lindman. Report No. 34. Los Angeles: University of California, Center for the Study of Evaluation, November 1968, pp. 48-52.

Lefkowitz, B., and D'Epsopo, D. A. "Analysis of Alternative Methods for Improving Racial Balance in a School District." Paper presented at the 31st meeting of the Operations Research Society of America. New York: May 1967.

Levine, S. L. "Economic Growth and Development of Educational Facilities, II." *Socio-Economic Planning Sciences* 2 (1969): 513-516.

Lindman, E. L., ed. Introduction. *Approaches to Program Accounting for Public Schools*. Report No. 34. Los Angeles: University of California, Center for the Study of Evaluation, November 1968.

Lindman, E. L. "A Three-Dimensional Program Account Classification System for Public Schools." In *Approaches to Program Accounting for Public Schools*, edited by E. L. Lindman. Report No. 34. Los Angeles: University of California, Center for the Study of Evaluation, November 1968.

Lindsay, F. A. *New Techniques for Management Decision Making*. New York: McGraw-Hill, Inc., 1963.

Linton, T. A. Foreword. *Program Planning-Budgeting-Evaluation System Design: An Annotated Bibliography*. Chicago: Association of School Business Officials, Research Corporation, December 1968.

Lipot, C. A. "Discussion of Issues." In *Approaches to Program Accounting*

for Public Schools, edited by E. L. Lindman. Los Angeles: University of California, Center for the Study of Evaluation, November 1968.

Lyden, F. J., and Miller, E. D., eds. *Planning, Programming, Budgeting: A Systems Approach to Management.* Chicago: Markham Publishing Company, 1968.

Mayeske, G. W. "The Development of a Model for Student Achievement." *Socio-Economic Planning Sciences* 2 (1969): 363-372.

McCullough, J. D. "Cost Analysis for Planning-Programming-Budgeting Cost-Benefit Studies." Santa Monica, California: The RAND Corporation, P-3479, November 1966.

McKean, R. N., and Kershaw, J. A. "Systems Analysis and Education." Santa Monica, California: The RAND Corporation, RM-2473-FF, October 1959.

McMullen, G. E. "The Los Angeles City Schools Approach to Program Accounting." In *Approaches to Program Accounting for Public Schools*, edited by E. L. Lindman. Report No. 34. Los Angeles: University of California, Center for the Study of Evaluation, November 1968.

Merck, J. W. "A Markovian Model for Projecting Movements of Personnel through a System." Lackland Air Force Base, Texas: Air Force Systems Command, Personnel Research Laboratory, Aerospace Medical Division, PRL-TR-65-6, 1965.

Midwestern States Educational Information Project. Documentation of Project Development and General System Design. Des Moines, Iowa: Department of Public Instruction, July 1968.

Millett, J. D. *The Process and Organization of Government Planning.* New York: Columbia University Press, 1947.

Miner, J. *Social and Economic Factors in Spending for Public Education.* Syracuse, N.Y.: Syracuse University Press, 1963.

Mood, A. M. "On Some Basic Steps in the Applications of Systems Analysis to Instruction." *Socio-Economic Planning Sciences*, no. 1, 1967.

National Education Association. "Planning for Educational Development in a Planning, Programming, Budgeting System." Report prepared for the Committee on Educational Finance, National Education Association. Washington, D.C.: George Washington University, State-Local Finance Project, 1968.

National Education Association. "What Is a Programming, Planning, Budgeting System?" *NEA Research Bulletin*, no. 4, 1968.

Oakford, R. V.; Allen, D. W.; and Chatterton, L. A. "School Scheduling Practice and Theory." *Journal of Educational Data Processing*, no. 1, 1966-67, pp. 16-50.

O'Brien, R. J. "Model for Planning the Location and Size of Urban Schools." Paper presented at the U. S. Office of Education Symposium on Operations Analysis of Education. Washington, D. C.: November 1967.

Ohm, R. E. "Gamed Instructional Simulation: An Exploratory Model." *Educational Administration Quarterly*, no. 2, 1966, pp. 110-122.

Peat, Marwick, Mitchell and Company. "Conceptual Design for PPBS for

the State of California School Districts." Report prepared for the California Department of Education. Washington, D.C.: June 1969.

Pfeiffer, J. *New Look at Education.* New York: Odyssey Press, 1968.

Philadelphia Board of Education. "The Proposed Operating Budget of the School District of Philadelphia." Philadelphia: School District of Philadelphia, 1969.

Popham, W. J. "Objectives and Instruction." Paper presented at the annual conference of the American Educational Research Association. Los Angeles: February 1969.

Quade, E. S. "Cost-Effectiveness Analysis: An Appreciation." Santa Monica, California: The RAND Corporation, P-3248, October 1965.

Quade, E. S. "Systems Analysis Techniques for Planning-Programming-Budgeting." Santa Monica, California: The RAND Corporation, P-3322, March 1966.

Quade, E. S., and Boucher, W. *Systems Analysis and Policy Planning: Applications in Defense.* New York: American Elsevier Publishing Company, 1968.

RAND Corporation, The. "Bibliography of Selected RAND Publications: Systems Analysis." SB-1022. Santa Monica, California: November 1967.

Rapp, M. L.; Brunner, G. L.; and Scheurer, E. M. "An Evaluation Design for San Jose Unified School District's Compensatory Education Program." Santa Monica, California: The RAND Corporation, RM-5903-SJS, May 1969.

Reisman, A., and Taft, M. I. "The Generation of Doctorates and Their Feedback into Higher Education." *Socio-Economic Planning Sciences* 2 (1969), pp. 473-486.

Rivlin, A. "Educational Policy and Educational Research." Paper presented at the annual conference of the American Educational Research Association. Chicago: February 1968.

Schick, A. "The Road to PPB: The States of Budget Reform." *Public Administration Review*, no. 4, 1966, pp. 243-253.

Shapley, L.; Fulkerson, D.; Horelick, A.; and Weiler, D. "A Transportation Program for Filling Idle Classrooms in Los Angeles." Santa Monica, California: The RAND Corporation, P-3405, July 1966.

Sherwood, R. P. "Cost Implications of Specific State Legislative Requirements: An Application of Program Budgeting to Selected California Unified School Districts." Unpublished Ed.D. dissertation. Berkeley, California: University of California, Graduate School of Education, 1965.

Sisson, R. L. "Can We Model the Educational Process?" *Socio-Economic Planning Sciences* 2 (1969): 109-119.

Sisson, R. L. "Some Results of a Simulation of an Urban School District." Philadelphia, Pennsylvania: Management Science Center, University of Pennsylvania, March 1967.

Stimbert, E. C. *Trends in Financing Public Education: The Proceedings of the Eighth National Conference on School Finance.* Progress Report on

Programmed Budgeting in Memphis. Washington, D.C.: National Education Association, April 1965.

Stone, R. A. "A Model of the Educational System." *Minerva*, no. 2, 1965, p. 172.

Stone, R. "Input-Output and Demographic Accounting: A Tool for Educational Planning." *Minerva*, no. 3, 1966, p. 365.

"This Is CLASS (Computer-Based Laboratory for Automated School System.)" *Phi Delta Kappan*, no. 8, 1962, pp. 348-350.

Thomas, J. A. "Educational Decision-Making and the School Budget." *Administrator's Notebook*, no. 4, 1963, entire issue.

Thonstad, T. *Mathematical Models in Educational Planning*. A mathematical model of the Norwegian educational system. Paris: Organization for Economic Cooperation and Development, 1967.

U. S. Senate Subcommittee on National Security and International Operations. *Uses and Abuses of Analysis*. Washington, D. C.: U. S. Government Printing Office, 1968.

Uxer, J. E. "An Operations Research Model for Locating Area Vocational Schools." Las Cruces, New Mexico: New Mexico State University, School of Education, 1967.

Wickert, D. M. "Allocating Financial Resources Using Legal Program Descriptions." Unpublished Ed.D. dissertation. University of California, Graduate School of Education, 1968.

Wildavsky, A. "The Political Economy of Efficiency: Cost-Benefit Analysis, Systems Analysis, and Program Budgeting." *Public Administration Review*, December 1966, pp. 292-310.

Wilson, C. Z. "The Use of Computer Simulation Techniques in Educational Planning." Paper presented at the annual conference of the American Educational Research Association. Los Angeles: February 1969.

Zabrowski, E. K.; Zinter, J. R.; and Okada, T. "Student-Teacher Population Growth Model." Washington, D.C.: U.S. Office of Education, OE-10055, 1968.

Part V

Educational Management Information Systems: Progress and Prospectives

John A. Evans

30

Introduction

SCIENTIFIC and technological innovations, implemented at an accelerating rate during the past fifteen years, have been a key factor in the rapid transition to a knowledge-based society. Many of these new tools and approaches have created opportunities for such organizations as schools to increase their managerial effectiveness. The means now exist, for instance, to improve the flexibility of the entire educational process. Activities within the school now amenable to improvement through these new tools include curriculum and content, organization and scheduling of instruction, school design, and school management.

Accompanying these opportunities are growing complexities plus increasing risks and costs. For example, choosing the right management-information-system (MIS) option from among a growing spectrum of alternatives is an increasingly complex and critical decision. Consequently, managers face a critical need to rethink their individual roles and to help reshape the goals and objectives of their organizations. This is especially true for educational managers, for, as John Diebold has said,

"Technology changes the need for education, develops from education and can save [or at least aid] education" (1969).

The impact of technology on education is nowhere better characterized than in the area of computers. A wide variety of new computer aids not only enable the educational manager to do the same job faster, but, more importantly, enable him to do *different* jobs while also stimulating his thought process.

Computers will place new requirements on what is taught and on how the educational system is managed. Some experts have predicted that by the mid-1970s 75 per cent of all students graduating from college will need a working knowledge of computers to get a good job ("How Computers Are Changing Your Life" 1969). The implications of the growing technology for the educational administrator are clear—he will be faced with increasingly complex decisions related to the raising and reallocating of funds and other scarce resources to obtain the computer aids necessary for assisting learners, instructors, and administrators. In short, computer aids will be competing for a significant portion of the limited school budget.

The identification of educational goals to match the new means that technology provides is one of the greatest problems of our time. Its solution can be one of the most exciting and important areas of human activity, and the time for that task is now. The task is especially difficult because it must be accomplished against a background of population explosions, social crises, and scarce resources. Furthermore, since the management of our individual minds, families, businesses, and institutions depends, in large degree, on the quality and relevance of education, the task poses an urgent challenge to educational managers.

Computer-based tools are potentially useful aids for the educational decision maker as he strives to solve important problems. However, if the tools are placed in the wrong hands, authority assumed from the control of information could threaten the very purpose of the educational system—at the very least, it would complicate the management of its renewal. Kalish has stated:

> The wrong people do the work and the research, which is often of questionable quality and usefulness. It would be nice if someone found the time and the courage to study the studiers, to analyze the analysts, to measure the measurers, and to make some strong recommendations about the recommenders.
>
> The computer, with its ability to arrange, disarrange, and rearrange millions of pieces of information simultaneously, tends to give its operators a feeling that the solution to any problem in the world lurks

> somewhere in the circuitry. . . . PPBS [planning-programming-budgeting system] with its hierarchy of goals and values, its guesses about what will happen five years from now, its assumption that all phenomena can be reduced to numbers and that all numbers can be arranged in systems is something that flusters the Assistant Secretaries [i.e. managers] and thereby makes consultants rich. (1969)

Looking toward the future use of computer-based management information systems in education, Frederick R. Kappel indicated a sensitive awareness of some of these pitfalls when he said, "Of all the tools mankind has ever had, this is the one that most preemptorially requires us to use our heads" (in Withington 1966).

The purpose of this paper is to contribute a better understanding of computer-based management information systems and their implications —an understanding needed by the educational manager because he is or soon will be renting, leasing, or buying systems for his school. In the following chapter, I discuss the key terms and concepts concerning management information systems. In chapter 32, I review the landmark developments, cited in the literature, relating to the evolution of information and educational technology. Current applications of this technology —primarily to the management of elementary and secondary school systems—and key limitations and gaps affecting its use are discussed in chapter 33. In the final chapter, I project into the next five years the growing impact of computer-based management information systems on education.

31

Definition of Concepts

MUCH of the semantic confusion surrounding the term *management information systems* (MIS) stems from the "partial" definitions of such systems prevalent in the literature. Most definitions reflect the bias of the author's discipline or experience. For example, the software specialist may define MIS in terms of a general data-handling support program, i.e., data-management systems (Gosden 1969). Similarly, the operations researcher tends to define MIS in terms of selected analytical tools (Hertz 1969). On the other hand, the management consultant with experience in manufacturing will tend to define a "total" management information system in terms of the information-support activities carried out by lower-level managers concerned with only one area of the business "system" (Brooker 1965). Furthermore, some managers tend to think exclusively in terms of paper work and people-to-people system networks, repressing the fact that the computer is rapidly becoming an integral part of the manager's information system.

These viewpoints—and others—incompletely characterize the elements of management information systems. In this chapter I hope to identify

some of the major biases and to provide a more balanced and integrated perspective for viewing management information systems.

Key Concepts

Eight concepts have been selected for discussion at this point because they will be used frequently throughout the paper:

- system
- management system
- decision-making process (system)
- management information
- information system
- educational system
- educational management information system
- computer-based educational management information system

Other terms of more limited usage will be defined later where appropriate.

SYSTEM

The word *system* has been used and abused to the point where it may have become the most prized cliche of the atomic/computer age. More than a dictionary definition* is clearly needed to place the term in a useful context for the educational manager. Oettinger agrees with my comment when he notes:

> To some extent speaking of systems is little more than appealing to a fashionable metaphor for the sake of snowing someone. Even then, this fad is not without merit as an antidote to that other pseudo-scientific fad, the precise and exhaustive analysis of an insignificant isolated effect under artificial conditions. Thinking "systems" at least reminds one that everything is related to everything else. Although necessary in practice, ignoring any one of these relations can be perilous; thinking "systems" alerts us to this peril. (1969)

Drucker (1959), emphasizing the information-flow and decision-making aspects of an organization, defines the organization as a *system*. The organization, whether an army or a business, is above all else, according to Drucker, an information and decision system. Information, ideas, and questions flow not only to and from the outside environment but to and from the people within. Furthermore the information not only has to be perceived and transmitted, but the relevant has to be separated

* One definition of *system*, according to Webster, is "an assemblage of objects united by some form of regular interaction or interdependence; an organic or organized whole: as the solar *system*, a new telegraphy *system*."

from the merely interesting. Then somebody has to make a decision, which in turn must be communicated to the places it is to become effective. Information and decision systems are around us everywhere; *every living being is one* and so is every machine. But of all these, the organization, which contains different types of both men and machines, is probably the most complex.

Barnard (1954) defines *system* as the consciously coordinated activities or forces of two or more persons. This definition avoids imputing to employees common motives and acceptance of common goals—a fallacious assumption commonly made by systems analysts. Coordination does not require agreement or personal involvement with organizational ends, only some incentive to conform as a means of control.

The business activities of an educational organization,* a major topic of this paper, can be defined as a *system* of interrelated parts working together to accomplish a number of goals, both those of the organization and of its individual members.

MANAGEMENT SYSTEM

The various definitions of *management* provided by many organizational theory experts are reminiscent of the story of seven blind men who were asked to describe an elephant. Each described only that part closest to him, e.g., the trunk, the tail, a leg. None realized he lacked the perspective necessary to describe the complete animal. Similarly, a jungle of theory and semantics confuses the meaning of the term *management*.

The behavioralists, born of the Hawthorne experiments (Roethlisberger 1968) and of awakened interest in human relations during the 1930s and 1940s, see management as a complex of interpersonal relationships and management theory as based on the tenets of the new and still not fully developed science of psychology. Others see management theory simply as a manifestation of the institutional and cultural aspects of sociology. Still others, regarding decision making as the central core of management, branch out in all directions from this core to encompass everything in organizational life. Many mathematicians think of management primarily as an exercise in logical relationships that can be expressed in symbols and the omnipresent and ever-related model.

But the entanglement of definitions reaches its ultimate when management is regarded as a number of systems and subsystems. The researcher using this framework understandably tends to be dissatisfied until he has

* The books by Carver and Sergiovanni (1969), Conant (1959), and Sexton (1967) clarify the unique characteristics of school organizations.

encompassed the entire physical and cultural universe within a management system (Koontz 1961).

Much of this type of confusion can be minimized, if not eliminated, and a balanced perspective achieved by:

1. Developing a *system* point of view, which includes being sensitive to but not blinded by the insights provided by the various disciplines
2. Focusing on critical business (administrative) decisions and decision makers and on those subsystems within organizations that acquire, process, or produce information affecting these decisions and decision makers
3. Viewing management in the context of an interrelated, multilevel decision-making process

Management (or administration) is thus viewed as the *process* of converting information into action. This process, in turn, is equivalent to a dynamic decision-making process (Barnard 1954) or *system* that cuts across formal organizational structures and that involves other organizations in the man- and/or machine-aided acquisition, processing, and use of information——the lifeblood of the process—as the basis for making various decisions (McCammy 1947, Newman 1964, and Simon 1960).

DECISION-MAKING PROCESS (SYSTEM)

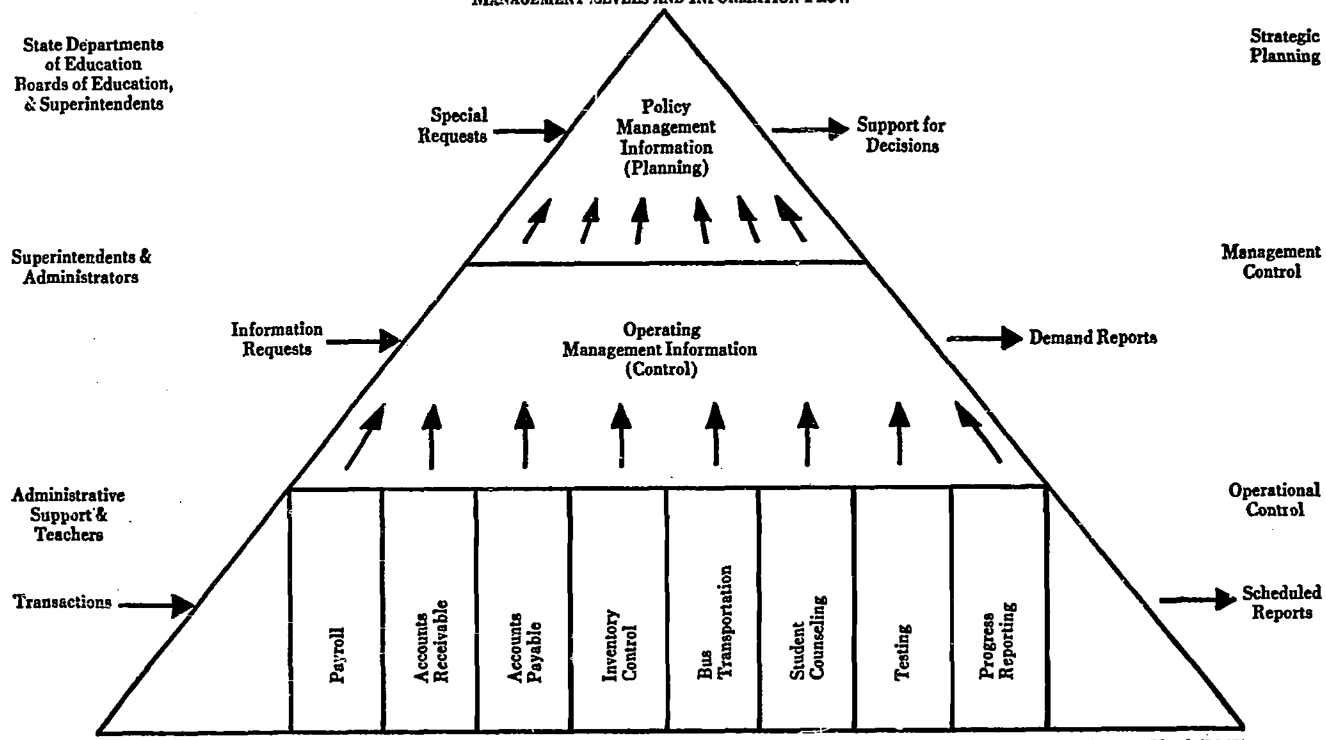
To more clearly understand the nature of the decision-making process, it is useful to identify the levels of management activity, the characteristics of the kind of decisions made at each level, and the basic sequence of activities within each level.

The decision-making process can be viewed as a three-level, hierarchically structured process as shown in figure 1. These three primary hierarchical levels correspond to those discussed by Anthony in his authoritative work, *Planning and Control Systems: Framework for Analysis* (1965). The Anthony framework, which removes some of the semantic smoke surrounding the relationship between management and decision making, defines three major decision levels:

1. *Strategic planning:* the process of deciding on objectives of the organization, on changes in these objectives, on resources used to obtain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources. In the educational system, this means policy planning primarily at the state department of education and board of education levels.
2. *Management control:* the process by which managers assure that

FIGURE 1

MANAGEMENT LEVELS AND INFORMATION FLOW



Source: Head (1967)

the resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives. In the educational system, this is carried out by superintendents, assistant superintendents, and principals.

3. *Operational control:* the process of assuring that specific tasks are carried out effectively and efficiently. In the educational system, this type of activity is conducted primarily by teachers in the classroom or within specialized administrative support operations, for example, by personnel responsible for daily plant maintenance and for financial and transportation operations.

The semantic smoke can be cleared even further by distinguishing among the characteristics of the decisions made at each level. These characteristics are categorized by four authors in terms of *structurability* (Simon 1960), *critical aspects* (Drucker 1954), and *dichotomies* (Dearden and McFarlen 1966). Figure 2 compares the classification schemes of these authors, thus synthesizing the decision characteristics they describe.

From the figure we see that structured or, at least, structurable activities (Simon) have the following characteristics: They exhibit a low degree of futurity, have less impact on the organization, include fewer qualitative factors, and are less unique and more frequent in occurrence (Drucker); also, they are equivalent to that type of business information characterized in terms of action-orientation, recurrence, formatibility, internal data acquisition, and reliance on historical data (Dearden and McFarlen).

As figure 2 shows, the more structurable decision-related activities exist at the operational control level. Thus it is easy to understand why the operational control level was the first managerial level to identify information requirements and to receive computer assistance. Conversely, it is also easy to see why it has been extremely difficult to define information requirements and to devise useful computer applications to serve the interests of higher-level management.

Within and between each management level a basic sequence of cyclical and interactive steps continually takes place. Various management groups at each level are continually involved in such activities as problem formulation; structuring and deciding among alternatives; developing and implementing policies, plans, and directives; and monitoring and evaluating the implementation of activities. Viewed this way, the decision-making process has a broad scope that includes more than the mere evaluation of alternatives. (Evaluation seems to be the exclusive focus of many of the economists and operations researchers who advocate more rationality in decision making.)

Figure 2
Management Levels and Various Decision Characteristics

Management Levels		Activities (& Outputs)	Characteristics	Simon	Drucker (critical aspects)					Dearden and McFarlen (dichotomies)				
				Decision Characteristics Classification Schemes										
				Structurability	Futurity	Impact	No. of Variables	Uniqueness	Frequency	Action vs. Nonaction	Recurring vs. Nonrecurring	Documentary vs. Nondocumentary	Internal vs. External	Historical vs. Future
State Departments of Education, Boards of Education, & Superintendents	(strategic planning)	• Set Objectives/Goals • Determine Resources To Be Applied (Constraints & Policies)	• Unpredictable • Variable • Staff Oriented • External Perspective	Low	High	High	High	High	Low	Nonaction	Nonrecurring	Nondocumentary	External	Future
Superintendents & Administrators	(management control)	• Allocate Assigned Resources to Tasks (Plans & Rules)	• Personal Style • Line Oriented • Internal Perspective											
Administrative Support & Teachers	(operational control)	• Use Resources to Carry Out Tasks (Actions & Reports)	• Stable • Logical • Predictable • Prescribed	High	Low	Low	Low	Low	High	Action	Recurring	Documentary	Internal	Historical

A clearer definition of the *decision-making process* can now be stated: a cyclical and interactive sequence of steps continually taking place within and between management levels so as to make and implement decisions.

MANAGEMENT INFORMATION

Management information can be defined as raw, uninterpreted statements of fact that, when interpreted by managers at various levels, have relevance and value to both the individual and the collective planning and control (or decision-making) process. *Data* relate to *information*, which in turn relates to *knowledge*, which in turn relates to *political* and *managerial power* (Hertz 1969 and Sage 1968) and to the *need to control* it judiciously (Bell 1969 and McFarland 1965)* in satisfying both the objectives of the organization in which it is embedded and the needs of society as a whole. To the extent that organizational goals and objectives are understood by management, the data can be more easily interpreted to determine their net worth, after considering the cost of collecting and maintaining the data.

A major pitfall can plague the evolution of computer-based educational management information systems. The problem is that managers may not define their goals and objectives in terms substantive enough that computer support professionals can assist in deciding what data to collect and maintain. The result is a wasteful misuse of unnecessary computer equipment and programs, unjustified reporting systems, inefficiently structured data bases, and inadequate and overly detailed management reports.

INFORMATION SYSTEM

In an educational system, then, an *information system* can be defined as a network of communication channels (voice, digital, etc.) that acquires, processes, stores, retrieves, and redistributes—i.e., *manages*—data used in managing the "educational plant" and in supporting the individual and collective decision-making process.

In short, an information system is a system for redistributing knowledge and power. This fact should be in every manager's mind as he contemplates introducing computer aids into his organization (Weiner 1954

* McFarland discusses the unintended redistribution of power within the organization. Bell describes the need to make more rational decisions in a politically sensitive situation.

and 1964). Lack of attention to this fact has caused many unintended and disastrous losses of time and dollars.

EDUCATIONAL SYSTEM

Education and learning occur continually at many places throughout our lives. The introduction of information systems will increasingly blur the distinctions between the formal system and the informal settings where education occurs (Drucker 1968). More learning will take place outside the traditional school setting—e.g., in the home, in the learning center, and on the job (McLuhan).

The focus of this paper will be restricted to the formal educational system, defined as the combination of facilities and organizational arrangements commonly referred to as the secondary and elementary school system (Oettinger 1969). Although this system exhibits social and bureaucratic characteristics common to other business and institutional systems, it differs markedly from them in a number of ways, making it a difficult system to characterize and analyze. Three reasons for the uniqueness of the educational system are:

1. Its goals and objectives are multiple, ill-defined, and unagreed upon.
2. The public-policy decision-making process involves numerous organizational entities (Oettinger).
3. Its products—the value added to its raw materials, i.e., students, as they pass through the K-12 time-phased system—are extremely difficult to measure substantively and to evaluate, in contrast to industrial products or institutional services, which are much more easily quantified.

As educational administrators, systems analysts, and business contractors plan the introduction of computer-based management information systems, they should contemplate the implications of the system's unique complexities and the increased blurring of boundaries between the formal and informal educational settings.

EDUCATIONAL MANAGEMENT INFORMATION SYSTEM

Educational management information systems (MIS) can now be defined by integrating the concepts previously discussed. An educational MIS acquires data from the educational system and the society, and manages these data in such a way as to make them useful. That is, it converts the data into information of use to managers at different levels,

places, and times in the decision-making process. An oversimplified view of an educational MIS is presented in figure 3. Note that the data and information come from various informal channels within the organization, not necessarily from a computer. The MIS in the diagram assists the manager in collecting facts about various subsystems, e.g., the financial subsystem. These facts in turn assist him individually (and collectively with other managers) to arrive at the decisions pertinent to his responsibilities within a particular hierarchical level, e.g., business functions at the management control level as in the illustration.

COMPUTER-BASED EDUCATIONAL MANAGEMENT INFORMATION SYSTEM

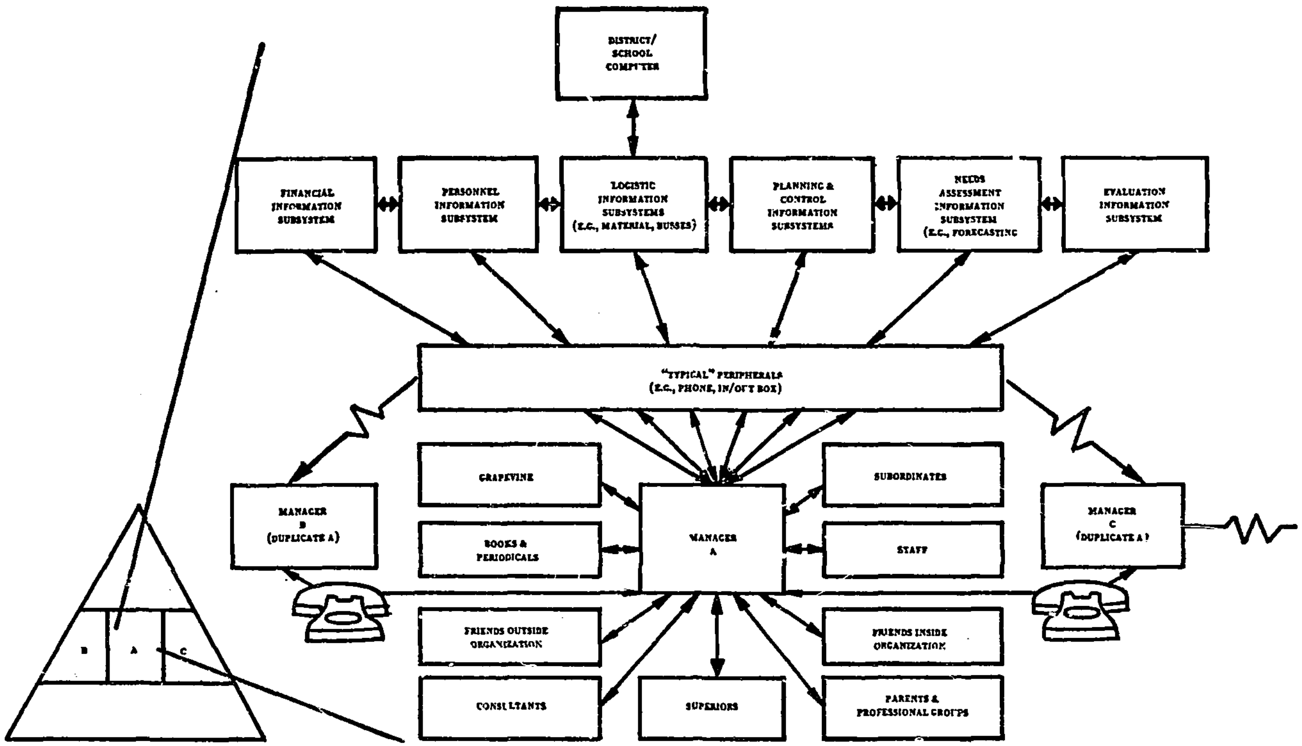
In this paper, the terms *educational management information system* and *computer-based educational management information system* are used interchangeably. The computer-based MIS differs from the noncomputer-based MIS in that additional input/output devices (e.g., peripherals such as data phones or display consoles) have been added to the normal peripherals (such as the in/out box and telephone). Although these computer devices may connect the educational manager to additional *data*, they may or may not connect him to additional sources of *information*. (Additional sources may provide the same information or additional but not relevant data.) Some of the major input/output peripherals made possible by information and educational technology are portrayed in figure 4. Their potential impact on computer-based management information systems of the future is demonstrated in figure 5.

FOCUS OF SUBSEQUENT SECTIONS

To place the evolutionary growth of educational management information systems in perspective, it will be necessary to refer to a broad range of topics. Much of the discussion, therefore, will be relevant to any management level (such as operational control); application (such as payroll); operational area (such as business); specific management function (such as control); and type of computer-based *support system** (such as a management information system).

However, primary emphasis will be placed on: decision-making activities of primary concern to the superintendent; business-oriented applications; major management functions (such as planning and con-

* These systems are properly called support systems because they are designed to assist different types or levels of management in the acquisition, processing, and use of data. For example, students are supported by computer-aided instruction (CAI) systems; teachers by instructional management systems (IMS); and educational managers by management information systems (MIS).



Source: Adapted from Steiner (1969)

FIGURE 3

"TYPICAL" MANAGEMENT INFORMATION SYSTEM

trol); management information systems in contrast to instructional management systems and computer-aided instruction systems; and information technology in contrast to educational technology.

FIGURE 4
CLASSIFICATION OF INPUT/OUTPUT EQUIPMENT

INPUT-OUTPUT

- INPUT
  - From men
    - Light pen
    - Key set
    - Dial
    - Typewriter
    - Switches
    - Voice
    - Physiological
    - Pictorial
    - Touch tone
  - From machines
    - Computer internal memory
    - Computer buffer memory
    - Character reader
    - Paper-tape reader
    - Punched card reader
    - Magnetic card
    - Magnetic tape
    - Disk file
    - Magnetic drum
    - Analog-to-digital converter
- OUTPUT
  - To machines
    - Computer internal memory
    - Computer buffer memory
    - Card punch
    - Paper-tape punch
    - Magnetic card
    - Magnetic tape
    - Disk file
    - Magnetic drum
    - Digital-to-analog converter
  - To men
    - Hard copy
      - Impact printer
      - Nonimpact printer
      - Plotter
      - Pictorial
      - Typewriter
      - Audio
    - Display
      - Character
      - Graphic
      - Pictorial
      - Projection

SOURCE: Parkhill (1966)

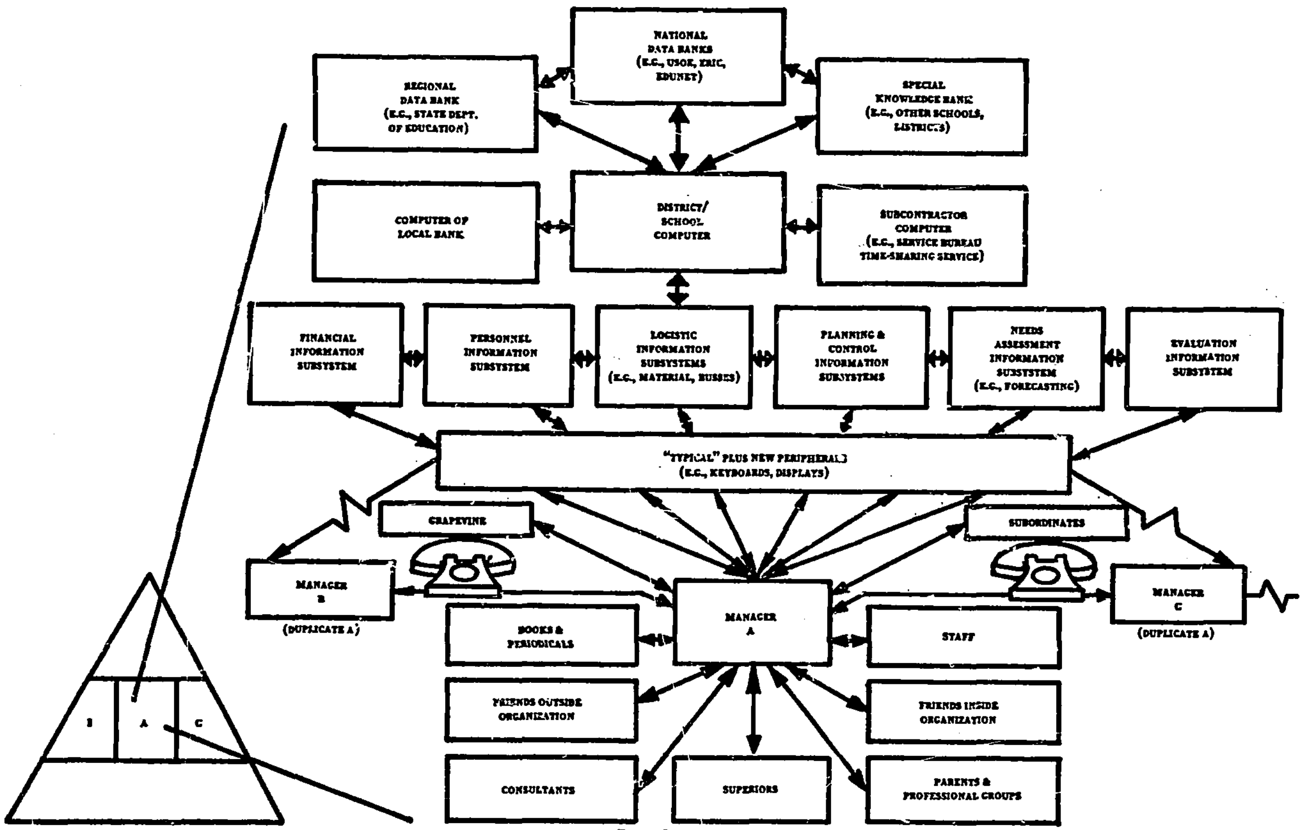


FIGURE 5

COMPUTER PERIPHERALS CHARACTERIZING "TYPICAL" MANAGEMENT INFORMATION SYSTEM OF THE FUTURE

32

Developments in Management Information System Technology

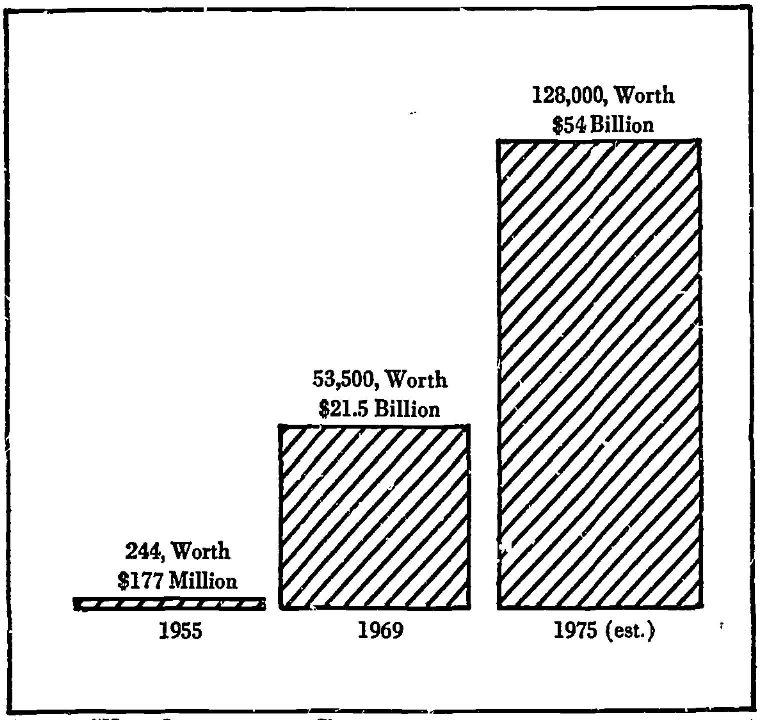
THE first commercial application of computer technology was in 1951. The explosive growth of computer systems since then is depicted in figure 6. More than 200 times as many computer systems were in use in the United States in 1967 than in 1955. The future development of computers implies an overwhelming impact on man, organizations, and society.

A review of milestones in the growth of computers will help to clarify their implications for education.

Computer technology has moved through three generations in fifteen years. These generations are reflected in the IBM family tree depicted in figure 7. Over this period storage costs in dollars per million additions declined from $10 to $.01 while computing speeds jumped from 500,000 additions per second to 1 billion per second. First generation computers were large electronic machines that used vacuum tubes and were capable of storing data and procedures. The transistorized computers of the second generation were smaller and more reliable processors. Integrated

FIGURE 6

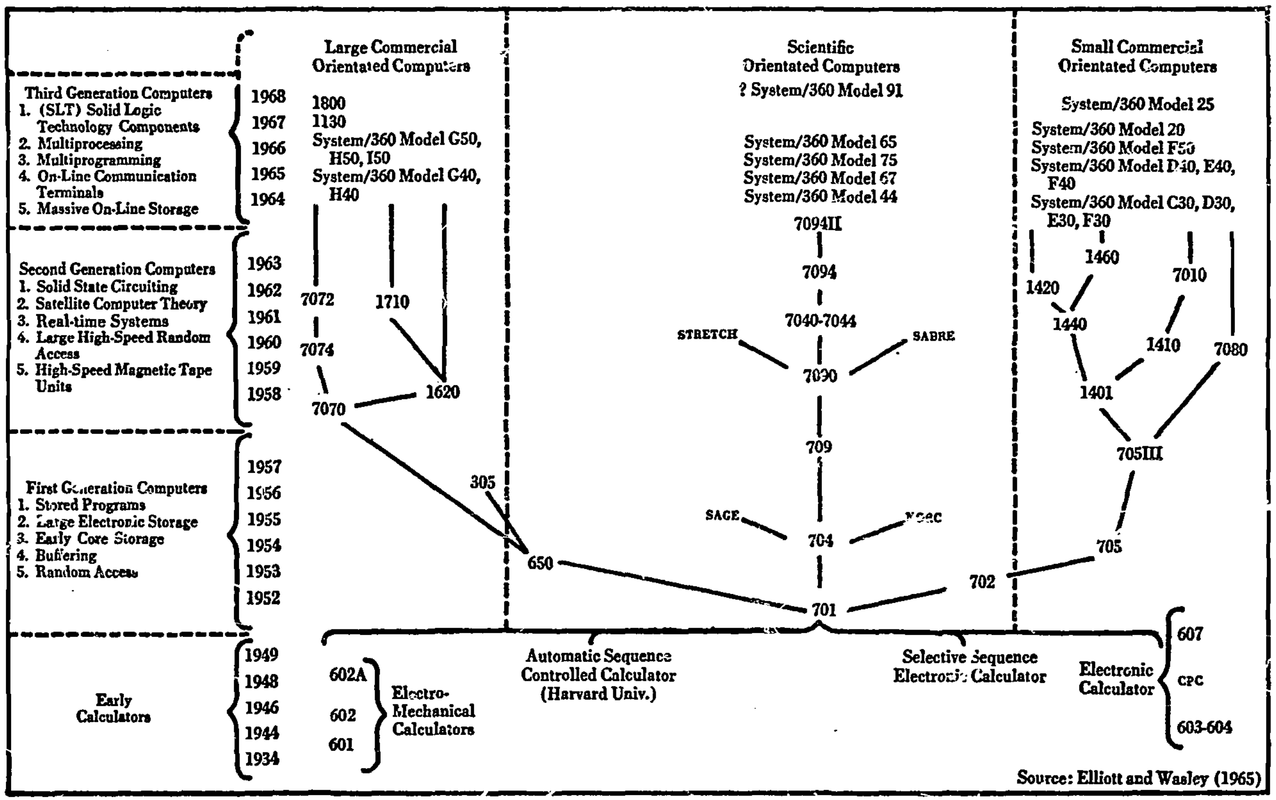
GROWTH OF COMPUTER SYSTEMS IN THE U.S.



Source: "How Computers Are Changing Your Life." *U.S. News and World Report* (November 10, 1969)

FIGURE 7

IBM FAMILY TREE



Source: Elliott and Wasley (1965)

circuits and families of compatible information machines, such as the IBM Series/360, make up the third generation. Already the fourth generation has made its debut, and technical journals forecast the fifth generation.

A parallel progression has characterized the use of the computer in the management system or decision-making process. Computers have advanced from routine calculation aids at the operational control level to planning and analysis aids that can support managers at all levels.

In short, computer power has grown from politically harmless but useful data processing applications to the point where it can provide significant assistance to lower and middle management. It is now technically and economically feasible to design configurations in such a way that computers can be a significant force in *redistributing power and knowledge* because of their potential impact on planning and control at all management levels.

Paralleling the development of computers are significant innovations, spawned by other technologies, that can augment or be augmented by computer-based information systems. Original applications of these innovations had specific uses—satellites for the military, TV for home entertainment, etc.—but their further potential lies in their ability to be integrated. Such integration will increase dramatically the number and kinds of options that can be considered in designing economically feasible management information systems. The fusing of technologies into a variety of MIS-applicable products will be a major trend of the 1970s. The progress of management information systems from the first generation computers through their incorporation into the "fused" technologies possible in the 1970s is depicted in figure 8.

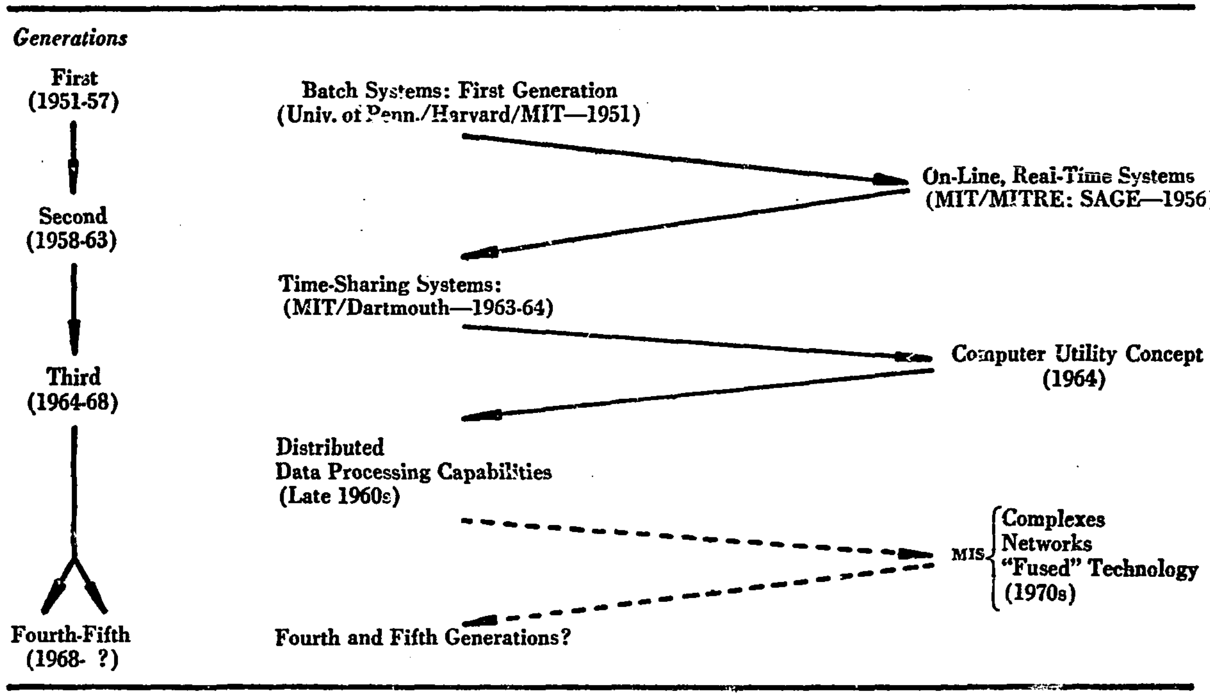
THE COMPUTER AS A DATA-MANAGEMENT-SUPPORT SYSTEM

The computer can be described basically as a data-management-support system consisting of two main components—certain pieces of equipment (the hardware) and large numbers of instructions (the software). These components allow the computer to perform the required data-management tasks. Hardware in turn consists of two components: the central processing unit or computer proper, and the peripheral units (card readers, magnetic tape readers, printers, TV sets, etc.) through which the manager, or the information specialist supporting him, communicates with the computer.

The basic data-management-support system in which the computer proper is embedded has certain capabilities provided by the hardware and can perform certain functions determined by the software. These

FIGURE 8

KEY MIS DEVELOPMENTS
(1951-1970s)



capabilities and functions are shown in figure 9. A number of manual, electro-mechanical, and electronic aids have been developed to assist in these basic data-support system functions (Blumberg 1965 and Elliott and Wasley 1965).

Major Inventions and Innovations

Some of the major inventions and innovations responsible for the rapid and diverse evolution of MIS capabilities are shown in figure 10. (Canning 1969 and Jequier 1969). These developments are responsible for the dramatic improvements in the size, capacity, cost, speed, and power of computers, as shown in figure 11. Ware (1967), Hobb (1966), and Joseph (1969) have surveyed the evolution of computer technology. See also "85,000 Computers by 1975; Operation Cost to Drop" (1966) and "Where the Action Is" (1969).

The predominant technological trend over the past fifteen years has been the decreasing cost of the computer relative to the whole system. In the early fifties, the user of the computer bought the hardware but had to develop a good part of the software (programs) himself since the supporting services offered by the manufacturer were minimal. Recently, however, the growth of business applications, pioneered by IBM, has caused manufacturers to increasingly emphasize software development and information services. Most of the new applications have been and are being achieved through new types of software, which is one reason for the emergence of a specialized software industry (Head 1968 and "A New Industry's Wild Ride" 1969).

As manufacturers increased their support services, the relative cost of computer hardware diminished. Other factors have also contributed to this trend. For example, tremendous advances in electronic component technologies have increased the reliability and efficiency of the components while allowing their cost to fall by a yearly average of 30 per cent. Since the central processor is composed mainly of such components, its price has declined commensurately.

Of all the major developments, software, because of its dominant impact on the growing diversity of computer applications, will be emphasized in the following discussion.

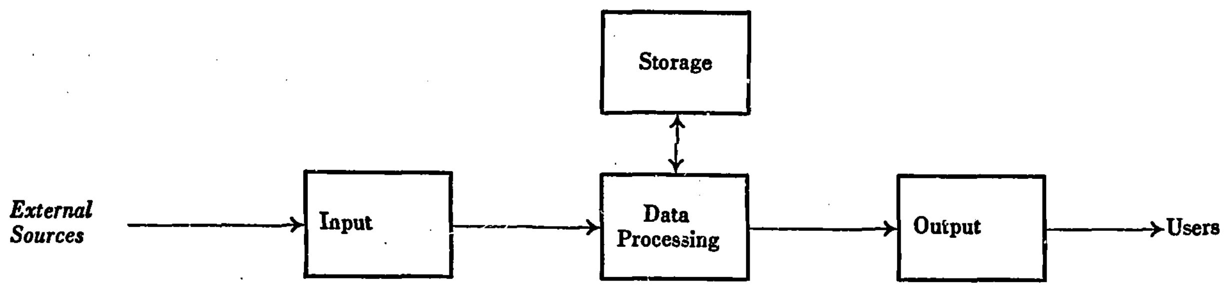
Key Developments in Information Technology

ON-LINE, REAL-TIME SYSTEMS

Definition. The term *on-line*, as applied in the context of a management information support system, has two common meanings. In one sense it refers to a system that processes input data as they are received

FIGURE 9

COMPUTER AS A DATA-MANAGEMENT-SUPPORT SYSTEM: BASIC ELEMENTS, CAPABILITIES, AND FUNCTIONS



	Input	Data Processing	Output
Hardware Capabilities	Electronic Semi-Automatic Manual	Mass Data Storage Data Processing In/Out Communications	Terminals and Peripherals (e.g., Displays, Hard Copy)
Software Functions	Management Monitoring Formatting Logging Screening	Data Base Maintenance Analysis Information Retrieval System Management	Managing Searching Editing Formatting Monitoring

FIGURE 10

MAJOR INVENTIONS AND INNOVATIONS IN THE COMPUTER INDUSTRY THAT IMPROVED MIS EFFECTIVENESS

Description	Type, country, and year	Responsible firm or individual	Remarks	Reduced Cost	Increased Responsiveness	Increased Capacity	Increased General-Purpose Capability	Increased Growth Flexibility	Increased Ease of Use
1. General theory of computers	A. France 1936	L. Couffignal	Unknown outside France				√		
	Germany 1936	K. Zuse	No publications. Totally unknown						
	United Kingdom 1937	A.M. Turing	Relatively important influence						
2. First electronic computer	B. Germany 1941	K. Zuse	Z3 Computer Unknown outside Germany						
	United States 1946	J.P. Eckert and J.W. Mauchley	ENIAC. Important work was also done by G. Stibitz at Bell Telephone (1940), H. Aiken and IBM at Harvard (1944), and V. Bush at MIT (late 1930s and early 1940s)						
	C. United States 1951	Remington Rand	UNIVAC I						
3. Internally stored program	A. United Kingdom 1937	A.M. Turing							
	United States 1946	J. von Neumann (Univ. og Penn.)							
	B. Germany 1941	K. Zuse	Z3 Computer				√		
	United Kingdom 1948	Univ. of Manchester	MADM } Close scientific interchange between the United States and the United Kingdom						
	C. United 1949	Univ. of Cambridge	EDSAC						
	States 1951	Remington Rand	UNIVAC I						

4. Subroutine concept	A. United Kingdom	1937	A.M. Turing		√	√		√	
	United States	1946	J. von Neumann						
5. Read-only memory	A.			The read-only memory has been used in automatic telephones exchanges					
	B. United States	1946	J.P. Eckert and J.W. Mauchley	ENIAC Computer. Limited storage	√	√	√	√	
	United Kingdom	1949	Univ. of Cambridge	EDSAC II Computer. Storage of the entire control information					
	C. Several countries		Most manufacturers						
6. Associative memory concept	A. United States	1946	V. Bush						
	B. United Kingdom	1952	Ferranti	ATLAS 360-67 } The full possibilities of associative memories have not yet been exploited		√	√	√	√
	C. United States	1965	IBM						
7. Microprogramming	A. United Kingdom	1948	Univ. of Manchester Univ. of Cambridge	Close interchange	√	√		√	√
	B. United States	1948	IBM (J. Backus), U.S. Navy (G. Hopper)						

(A = theoretical advance, B = first application, C = first commercial application) SOURCE: Adapted from Jequier (1969)

Figure 10 (continued)

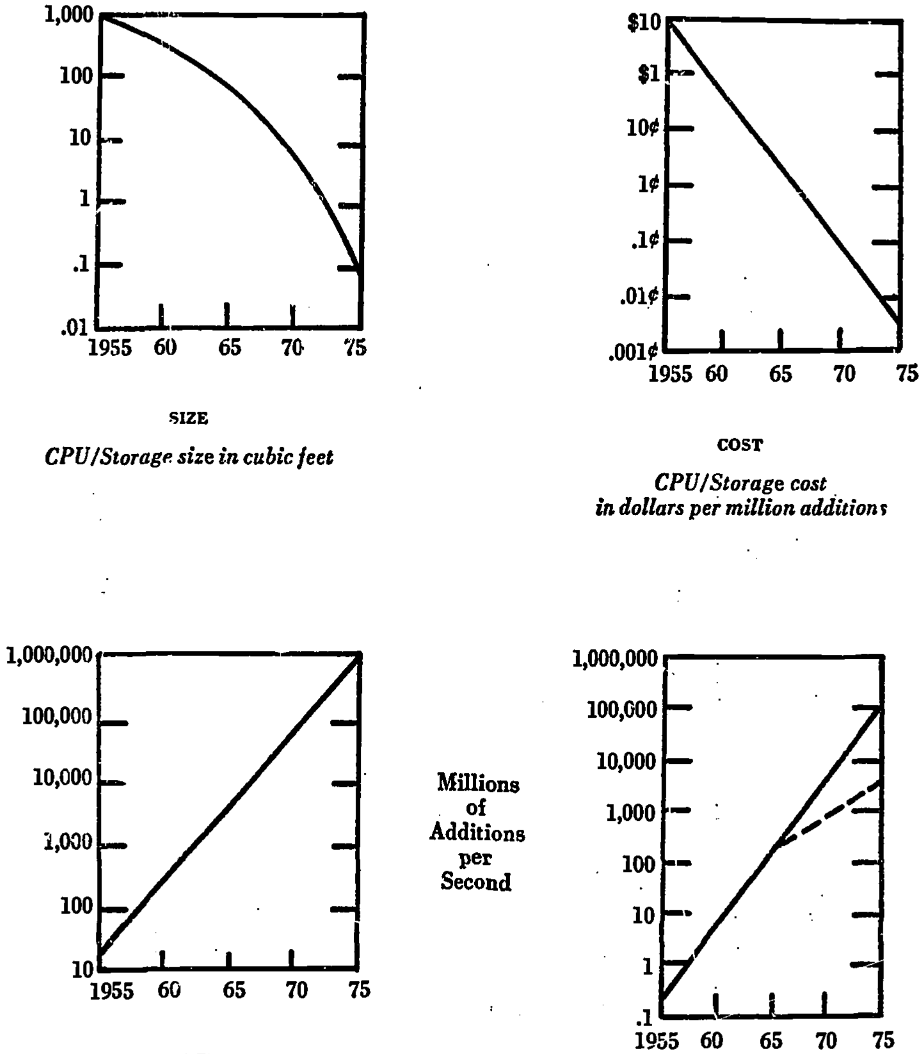
Major Inventions and Innovations in the Computer Industry That Improved MIS Effectiveness

Description	Type, country, and year		Responsible firm or individual	Remarks	Reduced Cost	Increased Responsiveness	Increased Capacity	Increased General-Purpose Capability	Increased Growth Flexibility	Increased Ease of Use
8. First compiler (A2)	B. United States	1951	U.S. Navy (G. Hopper)	In the late 1940s, Grace Hopper worked in the U.K.	√	√		√	√	√
	C. United States	1951	Remington Rand	UNIVAC I: first computer to have a compiler						
9. FORTRAN language	B. United States	1953	IBM Users Association	First FORTRAN compiler written by J. Backus of IBM	√	√		√	√	√
		1954	(SHARE) and IBM							
	C. United States	1954	IBM							
10. High speed drum printer	C. France	1954	Bull	First application of the "on the fly" principle for printing	√	√	√	√		
11. Ferrite core memory	A. United States	1955	MIT (Lincoln Laboratory)	Important work was also done at Harvard	√		√		√	
	B. C. United States	1956	Remington Rand, then IBM	UNIVAC 1103A, IBM 704 and 705						
12. Transistorized computers	A. United States	1947	Bell Telephone	Discovery of the transistor effect in 1947	√		√	√		√
	B. United States	1956	Bell Telephone	Leprechaun Computer						
	C. United States	1958	Philco, IBM, GE	Philco 2000, IBM 7090, GE ERMA System						
	United Kingdom	1959	Elliott	Elliott 803						
	Germany	1959	S.E.L.	ER56 Computer. (S.E.L. is a subsidiary of the American ITT)						

13. ALGOL language	B. Several countries	1958	ACM (USA) and GAMM (Germany)	ALGOL was jointly developed by American and European specialists convened in Zurich, Switzerland. The first ALGOL compiler was written by Dijkstra of the Netherlands.				√		√
	C. All countries after	1958	Several manufacturers	ALGOL was subsequently adopted by most manufacturers, and is presently more widely used in Europe than in the U.S.						
14. Multiprogramming	C. United States	1960	Honeywell	H800 Computer } No interchange independent developments	√	√	√	√	√	
	United Kingdom	1962	Ferranti	Orion I Computer } No interchange independent developments						
15. COBOL language	B. United States	1960	U.S. Department of Defense		√			√	√	√
	C. Several countries after	1960	Most manufacturers							
16. Family of compatible computers	B. United States	1955	U.S. Army	FIELDATA plan	√	√	√	√	√	√
	C. United States	1963 1964	IBM, Honeywell, RCA, GE, CDC	IBM 360 series. CDC 3000 and 6000 series, Honeywell H 200 series, RCA Spectra 70 series						
17. Time-sharing	B. United States	1964	MIT, Dartmouth College, GE	Civilian application (Project MAC)	√	√	√	√	√	√
	C. United States	1966	GE, then several large U.S. manufacturers (IBM, CDC, etc.)							

(A = theoretical advance, B = first applications, C = first commercial application)

FIGURE 11
GROWTH OF COMPUTER POWER



SIZE
CPU/Storage size in cubic feet

COST
CPU/Storage cost in dollars per million additions

SPEED
CPU/Storage speed in thousands of additions

COMPUTING POWER IN THE UNITED STATES

Source: Adapted from Ware *Computer* (1967)

and transmits output data immediately to the point where they are needed. The term has also been applied to auxiliary equipment such as input/output devices, which operate under the direct control of the central processing unit (CPU).

The meaning of *real-time* has become quite distorted. As used here it refers to a system that receives data, processes them, and returns the results to the user in time to satisfy the requirements for the job's completion. For example, it would provide fiscal data in time to be useful in preparing a budget or school-bus-availability data in time to prepare a bus schedule.

Thus, an *on-line, real-time* support system is one designed with sufficient capabilities to permit accomplishing the tasks of data management in time to satisfy the manager's job requirements.*

The origin of on-line, real-time systems dates back to SAGE, a semi-automatic ground environment system developed to strengthen U. S. air defense† (Everett et al. 1965). Subsequently, commercial air lines, large manufacturers, and banks and insurance companies employed these systems ("Airline Reservation Systems" 1962, Burck 1965, Desmonde 1964, Parker 1965, and Sprague 1962). Interestingly enough, however, unlike SAGE, few of these later systems used the procedural power of the computer to assist managers in planning.

Perhaps the best way to gain a clearer appreciation of the growing importance of on-line, real-time systems is to view them in the context of an evolving series of computer-communications systems, as illustrated in figure 12.

Uses. Not all managerial problems can be solved by the use of large, complex, on-line, real-time systems, or by any computer for that matter. As many military and industrial managers have painfully learned (Alexander 1969), these systems are best suited to situations having the following characteristics:

1. Large amounts of information need to be stored or processed.
2. Large numbers of interacting variables must be related or analyzed before a problem can be solved.
3. Repetitive activities exist, the decisions for which can be made more or less automatically.

* A more precise definition of an on-line, real-time system has been provided by Carroll (1967).

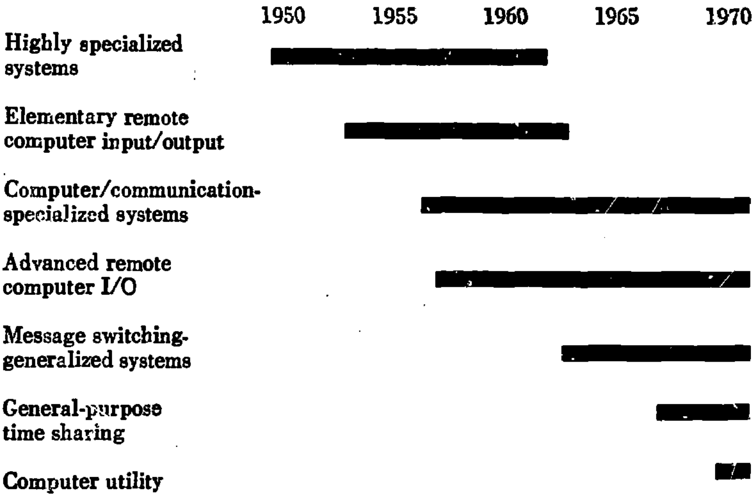
† This large-scale development effort, initiated at MIT/Lincoln Laboratory, resulted in the creation of The MITRE Corporation, which was charged with the further design and implementation of this system. Subsequently, The MITRE Corporation has developed other command and management information systems for military, federal, and, more recently, state and local governments.

4. Accuracy is important or useful.
5. Cost per unit of data output is low (Dearden 1964).

Specific applications for on-line, real-time systems are discussed by Canning (1967).

FIGURE 12

COMPUTER-COMMUNICATIONS SYSTEMS



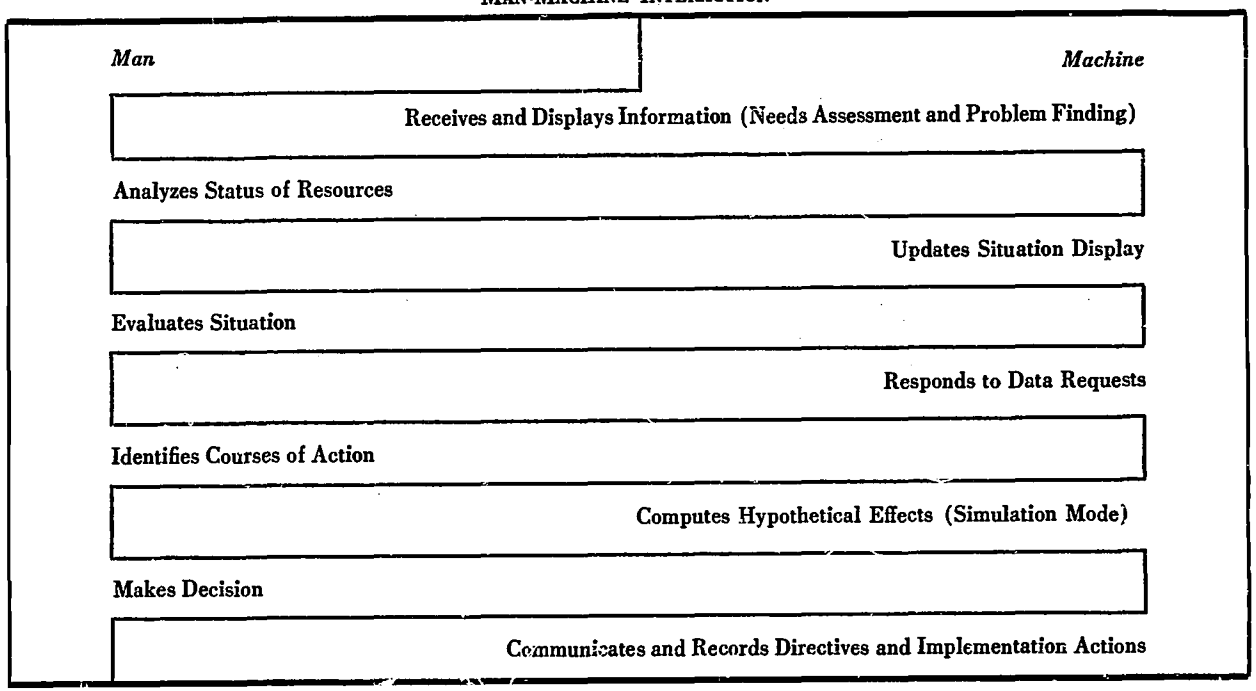
SOURCE: Bauer (1968)

Implications for education. Although real-time, on-line systems were developed and have been used until recently primarily outside the educational system, the development of important software capabilities holds great promise for the educational manager. Man-machine interactive design techniques, for example, can assist in some types of reporting, data analysis, planning, and evaluation activities (Canning 1965 and *Advances* and *New* 1967). A typical man-machine interaction is depicted in figure 13.

Educational managers will assign increasing importance to these systems and will more extensively apply such management science (operations research) tools as simulation techniques (Hertz 1969). Moreover, the availability of geographically distributed on-line, real-time capabilities should allow managers, who, because of lack of data, have had to

Figure 13

Man-Machine Interaction



rely on highly intuitive decision-making procedures, to change their aspirations, requirements, and behavior in finding and solving problems (Evans 1968 and Pounds 1965).

This type of system also should create additional pressure to gather more relevant data. Often a manager has only a hazy idea of the data he needs to solve a problem and he must see the answer to a query before he can phrase the next query. In such a case, fast response in providing the data is important. Most managers today are not using computer-based files in this way, so they are not aware of the need for fast response. However, this situation should change as the new type of interactive data service becomes available at sharply reduced costs per application via time-shared, terminal-oriented systems.

Recent developments in time sharing allow for extensive and widespread use of on-line, real-time capabilities. All that may be required is a common telephone and/or a TV set (Canning *Technical* 1967, Davidson 1966, Nuthmann 1969, and Smith and Goodwin 1969).

TIME SHARING

Definition. Time sharing is an application of real-time systems. Time sharing refers to the use of a large, general-purpose computer facility by many users remote from one another. Even though the users of the system place their orders independently of one another, the service received is instantaneous (or so it seems to the user).

Carroll (1965) defines *time sharing* as when an on-line, real-time system "time shares" the central processor and its files to provide multiple users with near-simultaneous access. In essence, the services of the computer are rapidly rotated among the several users who are stationed at remote consoles similar to typewriters (or other terminal devices). Each active user is provided with a short burst of exclusive service. These systems minimize delay between the problem-solver's proposal and the computer's disposal and eliminate the expense of making the computer await human reactions to its responses (Carroll 1965, Corbato et al. 1962, Glaser and Corbato 1964, and McCarthy 1962). The characteristics of a time-sharing system are listed in figure 14.

By July 1969 more than 100 time-sharing firms were in operation with over 275 installed systems.* By 1975 time-sharing services are expected to account for almost 25 per cent of the EDP business ("The Time-Sharing Segment of the EDP Marketplace" 1969). Whereas three years

* See "Time-Sharing Services" (1969) for a complete listing and description of the systems. Kimball (1968) has compiled a bibliography on time sharing.

ago no more than 500 terminals were on-line to time-sharing computers, today General Electric alone serves more than 50,000 time-sharing customers, and the field is one of the most rapidly growing businesses in the world (Bueschel 1969). The breakthrough year was 1968. The proliferation of time-sharing service vendors is shown in figure 15 and of connected terminals in figure 16.

FIGURE 14

CHARACTERISTICS OF A TIME-SHARING SYSTEM

1. Fast response
2. Unique hardware:
   - Programmed transmission control
   - Secondary storage, such as disks, drums, and so forth to be randomized
   - Terminal devices capable of communicating
   - Sufficient data channels
   - Memory protection (either a hardware or software feature)
3. Unique software:
   - Monitor systems
   - Swapping systems
   - File updating
   - Schedulers
   - Usage authorization systems
   - Plus a whole rationale of higher-level operating systems commands
4. A querying scheme that allows multiple users to be serviced

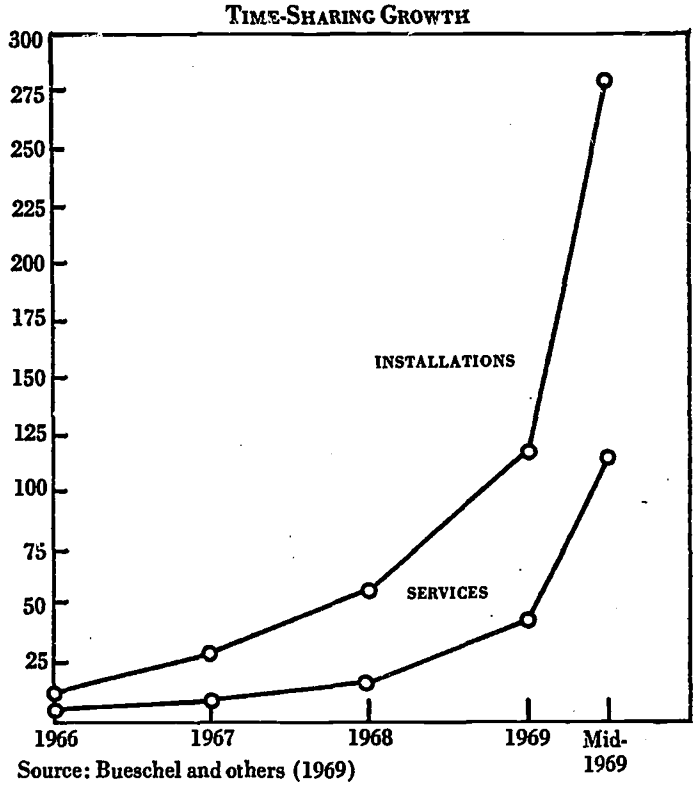
SOURCE: Bueschel et al. (1969)

Four major types of service vendors dominate today's time-sharing marketplace: (1) the main equipment manufacturers, such as IBM and GE, with computers readily at their disposal; (2) the companies that for several years supplied "traditional" data processing services; (3) the independent services started by forward-looking entrepreneurs; and (4) the organizations that traditionally have been large computer users, such as aerospace companies, large manufacturers, and banks, whose managers decided they could make money by selling their expertise to others ("GE Announces $34 Million Investment to Implement Nationwide Network for 'RAIR' and Other On-Line Services" 1969).

A representative sample of current time-sharing systems and their "accessibility"—whether they are local or national—are shown in figure 17. The services offered by these time-sharing vendors include:

FIGURE 15

TIME-SHARING GROWTH



Source: Bueschel and others (1969)

Figure 17

Scope of Services and Accessibility of Time-Sharing Systems

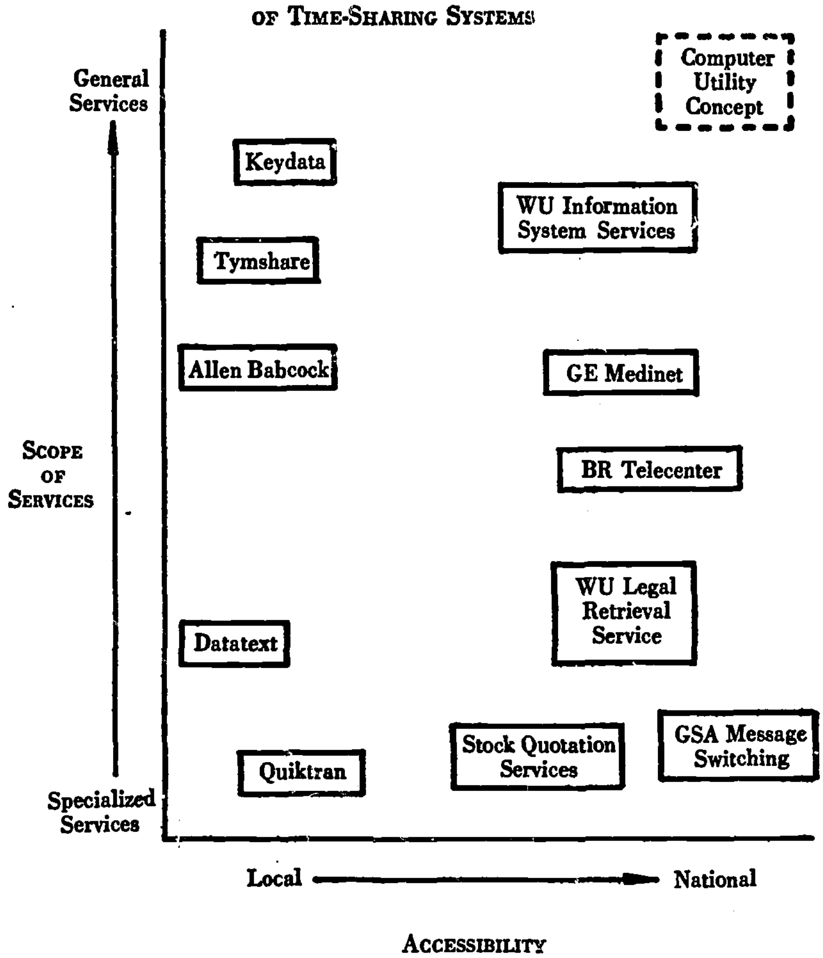
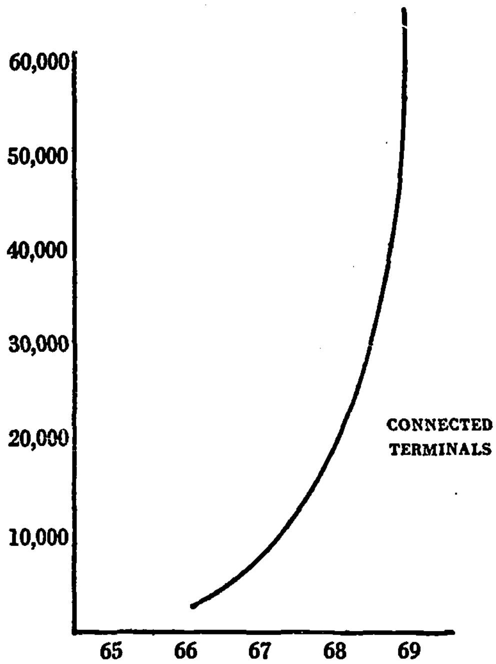


Figure 16

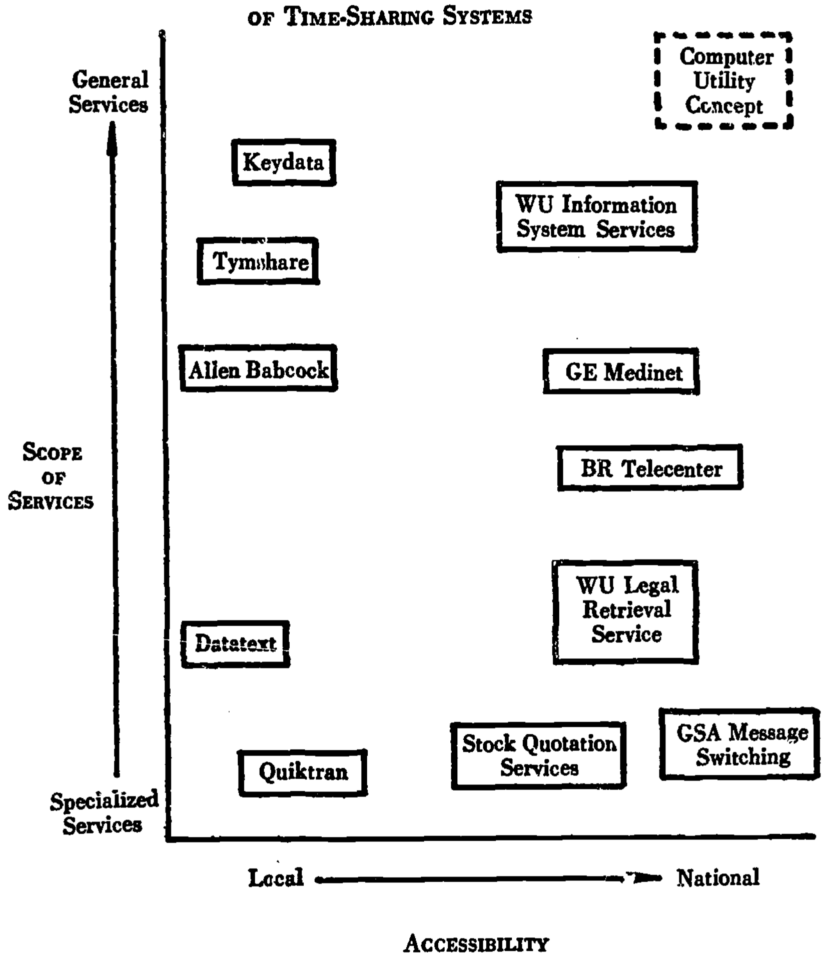
Proliferation of Terminals



Source: Bueschel (1969)

FIGURE 17

SCOPE OF SERVICES AND ACCESSIBILITY OF TIME-SHARING SYSTEMS



- conversational time-sharing
- on-line batch processing
- data processing application packages
- terminal sale and lease activity
- contract services
- training for customers ("GE . . ." 1969)

As figure 17 shows, most current time-sharing systems only offer services that are specialized or local. These systems fall short of the ultimate computer utility—a general-purpose time-sharing system offering a large scope of services nationally.

Uses. The variety of uses conceived for time-sharing systems are too numerous to mention. However, some major applications include:

- *problem solving* through interaction with the computer, e.g., budgetary plan simulation (Licklider 1960 and 1965)
- *computer program development*, i.e., use of time-sharing service diagnostic aids to write an application program
- *mass-data entry*, e.g., entering daily attendance data into a central file for management reporting
- *inquiry response*, e.g., analysis of management reports indicating budget overruns
- *data collection and examination*, e.g., exchange of test score data to permit managers in different geographic locations to compare statistically various educational tracks and equivalent grade levels
- *message transmissions from station to station*, e.g., updating of financial and inventory data
- *computer-assisted instruction*, e.g., use in conjunction with other capabilities to allow geographically dispersed students to self-learn a particular subject
- *remote batch job submission*, e.g., use of time-sharing service terminal to enter attendance and/or financial data for analysis elsewhere
- *process control*, e.g., automatic alerting, maintenance, and operational control of the educational plant (Canning 1969)

Implications for education. The major implication of time-sharing for educational managers is that the wide range of computer services available today will continue to grow exponentially in the near future. The tremendous growth of these services will pose both an opportunity for managers to improve their effectiveness and a potential danger that their

power may be redistributed in unintended ways. Availability of these services will also increase, allowing the manager to have information support services without acquiring his own inhouse facility. Also, the declining cost of these services along with their growing availability will make them of use to any educational manager regardless of his school district's size or location.

However, many considerations must be weighed and balanced in selecting a particular time-sharing service. From the educational manager's point of view, four major criteria must be considered:

- system reliability and availability
- program library
- customer service, support, and individual training
- price ("GE . . . " 1969)

The first consideration is of most interest to the educational manager. Time-sharing service vendors find that their business customers want the system to be ready and waiting when they want to use it, usually between 9:30 and 11:30 A.M. and then again between 1:30 and 4:00 P.M. Because of this problem of peak-load use by business customers, several time-sharing services have offered special rates to schools and universities who would agree to use the services at other than peak hours. Vendors have also tried to line up users in other parts of the country.

Another important consideration is price. No matter where he is located or with what size school district he is associated, the educational manager must pay increasing attention to the budget item devoted to time-sharing services and to data processing services in general. Time-sharing vendors base the charges for their services on all or a combination of seven factors: terminal connect time to the computer, central processor unit time, storage, file access, languages, monthly minimum, and accessibility.

In assessing the cost of the service, however, the educational manager should not be so much concerned with the price of the service as with the very *survival* of the organization or organizations offering the service. A permanent interruption of services caused by a business failure or takeover could cause an operational crisis and involve substantial costs and delays in transferring the same services to another company with different support system capabilities.

Educational managers should also be aware of the risk of interrupted service due to the competitive pressures that typify many of the special-purpose, locally based time-sharing services. Many local companies soon

will be absorbed into larger and fewer national networks that will offer a greater variety of software packages and proprietary data bases. Firms that will not survive probably lack one or more of the *basic ingredients of success* of which educational administrators should be aware:

- a system programming staff to maintain software independence, and a continuing research and development program
- a systems operations staff capable of communications design, implementation, and maintenance
- a staff that realizes computer time sharing is not a simple machine time-vending operation but one requiring continuous customer education and service
- an adequate market penetration, featuring comprehensive and widespread geographical service, sufficiently broad in scope and in unique user applications
- an adequate investment and/or working capital

Students and parents can also be expected to catch on soon to the potential benefits of this type of service. The educational benefit is underscored by the experience of a Los Angeles school district as far back as 1967. After installing two systems for student usage, the school district observed a noticeable improvement in the attitudes of numerous students toward mathematics in particular and learning in general (Besel 1967).

In summary, time sharing has a great potential for assisting the educational administrator both in managing the information explosion and in furthering his professional education by updating his skills. Other benefits will be derived from the systems as well. For example, the laboratory program for computer-assisted learning (Project Local), now in its second phase, will afford the staffs of its member schools an opportunity to investigate applications in the areas of administration, educational/community research, adult education, and inservice training ("Small Time-Sharing Series Suitable for Schools" 1968).

INFORMATION UTILITY

Definition. The term *information utility** was first publicly used by Professor Martin Greenberger of MIT in 1964 when he made the following prediction:

> Barring unforeseen obstacles, an on-line interactive computer service provided commercially by an information utility may be as commonplace in 2000 A.D. as telephone service is today.

* The terms *information utility* and *computer utility* are commonly used interchangeably.

The term is derived from the concept of the public utility, which supplies a service to many subscribers for a charge based on usage. The user may also pay an installation fee or a monthly service charge for one or more instruments on his premises. The service offered by an information utility may include the collecting, storing, processing, analyzing, computing, and displaying of information. An important application of the information utility concept is that of dealing with actual money and financial transactions. This coming type of utility will make the "checkless society" a reality (Sprague 1965).

In contrast with today's more limited time-sharing services, the computer utility is conceived of as the ultimate service in providing general-purpose information on a national basis (see figure 17). In fact, some observers have predicted that the locally based time-sharing services are only a beginning stage in an evolutionary process toward a master information utility serving the needs of every man in any environment—home, school, or business.*

A computer utility would not merely dispense raw computer power in the same way that a light company dispenses electricity. Successful use of computers requires the conception of feasible programs (software) in addition to the hardware. Because of the tremendous variety of systems and applications requirements, no single organization could likely provide all information services, let alone provide them well (Hunt 1966). Therefore, the single, all-purpose computer facility that the word "utility" suggests probably never will exist.

Problems. A broad range of political, social, economic, and technical problems confronts the evolution toward all-purpose computer utilities. In the political and social realms, the public is increasingly aware of the potential threat of "big brotherism" and the scientific community is likewise concerned over the control and assessment of technology ("Assessing Technology" 1969). The federal government also has displayed concern regarding the implications of computer technology for security, privacy, and the law (Baron 1967, Bigelow 1967, Federal Communications Commission 1966, and Ware 1967).

Finally, a host of technical problems related primarily to communications and software will further constrain the development of computer utilities (Fine et al. 1967, Ginsburg 1965, Hext 1967, and Hittel 1966). Even putting aside public interest considerations, it is easy to see how

* Because information utilities represent an extension of time-sharing services, their applications are essentially the same as those discussed in the previous section and will not be repeated here. Problems unique to such facilities are discussed, however.

the use of central information utilities by many users from various locations with various jobs to be serviced can approach the point of diminishing returns and fall considerably short of the ultimate promise.

Future development. The growth of computer utilities will probably be based on the technological advances of previous computer/communication systems. During the 1970s the use of computer services will increase dramatically and perhaps even surpass the use of privately owned computers. Forecasts indicate that by 1970 three out of every four computers will have a time-sharing capability, and by 1975 total computer usage will be "on-line," with one out of every two computers tied to national communications networks (Irwin 1966 and Zani and Zani 1969). Parkhill (1966) expects the transition to a "checkless society" to be substantially completed by 1976. Components for the "fireside computer" are available now, but not at the $1,000 price projected.

The many forces now at work shaping the trend for services will increase in strength in the next decade. Many of the smaller independents will drop out of this field, some of them being absorbed by national or regional chains. Local independents that remain will specialize in providing custom-tailored user services. Voluntary cooperatives will find it difficult to match the range of services available from the large computer service organizations. Finally, many small- to medium-scale "in-house" computers probably will be replaced. The users of these computers will rely increasingly on suppliers of computer services.

Parkhill (1966) appropriately sees the growth of computer utilities as a trade-off between positive and negative factors. The key positive factors are fast response, reduced user capital investment, more efficient use of computer power, better balance between user needs and user costs, greater computer power for users, convenient access to a broader data and procedure base, flexible system augmentation and modernization, and reduced user maintenance and operating costs.

On the negative side, the following factors tend to inhibit growth: cost of communications facilities, executive control requirements, reliability and maintenance problems, system saturation problems, and lost time due to "swapping" the multiplicity of user jobs in and out of the core memory to achieve a satisfactory response time.*

* Recognition of these negative factors was the main reason The MITRE Corporation focused its design effort on the development of distributed data processing capabilities (to be discussed next) as a means of compensating for these limitations without sacrificing the advantages of the utility concept.

Implications for education. The implications of the computer utility for education are revolutionary. The potential opportunities implied and the problems just discussed pose dramatic consequences for the formal educational system—its organization, the type of educational services it provides, the time and place they are provided, and the knowledge acquired in terms of managerial responsibilities and tools.

The evolving computer utilit*ies* (there will be more than one) will create pressures and opportunities to do the following:

- improve the effectiveness and efficiency with which the educational system (K-12) is managed
- accelerate the degree to which education takes place outside the formal organizational system, e.g., in the home, in the learning center, and on the job by group or individual inservice training
- equalize educational opportunity regardless of the economic status of the community within which the school district resides

The risks associated with effectively harnessing this capability to meet educational needs are also great. Oettinger notes that the school system

> is an extraordinarily complex system and techniques have yet to be developed that can subject it to a generally exhaustive systems analysis —knowledge about how to apply technology is even more primitive; teaching methods and curriculum content remain virtually unmodified by the availability of new devices. (1969)

A recent feasibility study of a large, central computer facility for education ascertained some prospects and problems (Anderson 1968). Several benefits were identified as deriving from such a central facility:

1. Assuming the computer is "good" for education within certain limits, a computer utility could provide more students with personal use experience.
2. Duplication of very costly development work could be avoided, thus eliminating the tendency for school computer installations to repeat the development of relatively low-level (although useful) jobs.
3. Large and relatively uncontrollable costs, many of which are hidden, could be avoided.
4. The potential for interaction among schools with regard to student use could be exploited.
5. The potential usefulness of a centralized effort to help indi-

vidual schools that encounter difficulties, such as in curriculum development, could be explored.

Many questions raised by the report remain unanswered: What new problems will need solution? What will be the relationship of the governing board to the school served? How will patterns of interaction be worked out with top management for organizational change? How can a desirable degree of self-identity be retained?

Additional questions concern the unique experimentation with and development of the school: How can the computer's effect on learning be evaluated? How can administrative responsibility be redefined in view of the cross-functional impact of the computer on management? How should information requirements be determined when using a new system over which a school does not have full control?

The report concludes cautiously but positively as follows:

> We can't yet answer questions about the benefits versus costs of computer services. We aren't sure how to project the workload for a proposed central facility nor are we sure of the political settings in which effective change can occur. The human problems seem to outweigh the technical problems today. At this point in time it will be very interesting and probably very valuable for education to continue to develop work leading toward the creation of a pilot central computer facility for education. (Anderson 1968)

DISTRIBUTED DATA PROCESSING

Definition. Experts differ on the meanings they assign to distributed data processing (DDP). One working definition of DDP used at The MITRE Corporation is that it is a system network organized hierarchically (in terms of the complexity of given data processing operations), where the location of user work stations or terminals is not constrained by the location of the more powerful central processing facility (Summers in press). The DDP concept calls for fast response to the user because the system's design allows different functions to be performed in different parts of the system, the more frequent and simpler tasks being accomplished at remote user stations on the periphery of the system. The system can provide services at three different hierarchical levels: the terminal (at the user's desk), a small data-management computer (remote from the user), and a large processor (also remote). Using their desk terminals, geographically separated managers can interact with one another by means of the data processors (or data phones).

Recent developments in data communications have made an awesome variety of terminal configurations technically and economically feasible.

With these new terminals the remote users can interact directly with a large-scale computer facility, which may be operated "inhouse" or contracted on a time usage basis, e.g., from a time-sharing service. This capability can also be supplemented by the growing availability of mini, micro, or "desk top" computers, either unconnected, e.g., free-standing,* or connected to the distributed work stations (Bothwell 1969 and Peck 1968).

Purpose. The basic purpose of DDP is to provide the right computer or the right capability for a particular job. This concept, just emerging commercially, is based on an interconnection of computers of varying capability so that a user's job can be switched from one computer to another as the complexity of the job varies. The simple jobs, e.g., querying, report formatting, and information retrieval from a limited user planning file,† are assigned to the small local computer. The more complex or time-consuming jobs are performed by computers elsewhere in the network. This system also allows use of combinations of geographically separated specialized computers, for instance, one for high-speed file handling, one for parallel computation, and one for series computation.

The communications system is an integral part of the overall computer hardware/software design. Interactive computer-communications systems for this type of configuration must be designed with a different emphasis than is customary. The emphasis must be on utility for the user rather than on message densities and network design. The terminal becomes the focal point, therefore, with the rest of the system dependent on it.

In contrast to DDP, other time-sharing systems represent, for some applications, a costly alternative. They require that the expensive central computer, connected to remote terminals whose equipment has no logic capability, service even trivial job requests. Basically, the peripheral equipment in time-sharing systems is designed for input and output of data to the central computer. This means that a tremendous amount of the large system's potential is wasted on routine functions such as entry-message-preparation, perhaps of the type associated with payroll and accounting activities. Thus, the computer, which must have a capacity large enough to handle the biggest problems, also must act on demand

* Gruenberger (1966) and Solomon (1966) discuss the pros and cons of free-standing computers.

† Planning files are those files that a user, in the course of his daily activities, builds over time. This individual file is a subset of a larger data base acquired from remote computers.

as the sole data processing service for users with trivial demands (Bennett 1969).

Implications for education. The advent of distributed data processing will permit all educational managers to realize increased savings, effectiveness, and efficiency in the task of data management. The advantages of the system should lead educational managers who already have some form of computer-based management information system to reconsider both their present system and even the value of having an "inhouse" EDP department (Roberts 1968, "Is the EDP Department Headed for Oblivion?" 1969, and "When EDP Goes Back to the Experts" 1969). The educational manager can now choose among an increasing variety of alternative designs, services, and terminals for solving his data handling problems. Not only must he contend with the selection of the right educational innovation and project, but he must begin to give more serious and systematic thought to selecting the right information support system.

Other Information-Related Technologies

Several additional innovations, when integrated and applied to education, will greatly amplify the effectiveness of educational management information systems in the 1970s.

Besides the more commonplace peripherals, the simplest appearing new aid is the data phone, soon to be followed by the picture phone (Rossi and Biddel 1966, Sims 1969, and Smith and Goodwin 1969). New tape recording and playback systems make use of holographic and laser techniques ("RCA Puts TV in Packs: New Home TV Player System Using Lasers and Holography Sets Company in Race against CBS for $1-Billion Market" 1969 and "TV in a Cartridge Sparks 3-Way Tiff" 1969).

Even more dramatic in its potential impact is cable TV ("Cable TV Leaps into the Big Time" 1969 and "Community Antennas Enter the Big TV Picture" 1965). If its proponents are correct, as many as 30 million homes, about half of the households in the United States, will be wired for cable TV within five years. With a capacity 1,000 times that of a telephone wire and 4 times that of a standard TV transmission cable, it will give a new dimension to person-to-person communication.

Numerous channels on the cable will be available for the transmission of information; facsimile newspapers are already under consideration ("The American Telephone and Telegraph Company's High-Speed and Facsimile System National Network" 1969). With data processing ter-

minals attached, the surplus channels could be used to monitor and interact with the local school board during its meetings, for example.

Satellite television represents another extension of technology. When integrated with cable TV, the combined system will be far more efficient and economical than direct satellite broadcasting. By 1972 Canada will begin operating the world's first modern domestic communications satellite system ("A Satellite That Talks Canadian" 1969).*

Finally, communications, computer, and television technologies are being combined into low-cost systems intended for mass distribution of information (Nuthmann 1969). The primary purpose of these interactive capabilities is to teach basic skills to urban students. This same fused-technology approach has been conceived to serve the needs of various types of public managers, including school managers (Carroll 1967).

NATIONWIDE NETWORKS FUSE INFORMATION TECHNOLOGIES

Stimulated by evolving technologies (holography, lasers, satellites, TV, etc.), many once-independent computer-communications complexes are combining into various types of interdependent nationwide networks that fuse the technologies to communicate information (Zani and Zani 1969). A growing number of these networks are designed wholly or in part to assist high schools and colleges (Brown et al. 1967, Roberts 1968, Sielman 1968, "Potential Resources for EIN" 1968, "The Computer Utility: Implications for Higher Education" 1969, "The First Grant in a Program to Determine the Value and Cost to Educational Institutions of Sharing Computers and Related Activities" 1968, and Steinhardt 1968). The networks facilitate rapid access by an educational manager or a student to such "islands of knowledge" as data banks, application packages, and information services that have been developed elsewhere. This growing variety of communication devices—from audiovisual to more sophisticated intellect-augmentation aids—are affirming Mc-Luhanesque thesis that the medium will be the massage to manager and student alike.

The growth of communication networks has also generated interest in integration—both horizontal and vertical—of some of the systems related to MIS. The next five years will see growing pressures to integrate, for example, the information retrieval systems originally designed for

* Although the United States pioneered the development of military satellite communications, the Canadian domestic system has apparently managed to avoid many of the political problems that confront the United States' planned system ("COMSAT Urges Own Satellite System" 1969).

library applications (horizontal integration). Vertical integration will be achieved as the management control and strategic planning levels begin to use, for example, some of the transactional data generated at the operational level. This coming fusion of information retrieval systems and management information systems is inevitable if the *external* information needs of higher-level management are to be served by a computer-based management information system.

Implications for Education

What do all these advances in fused technology imply for the educational manager? Overhage envisions the following situation:

> A lecture may be transmitted to an overflow audience by closed-circuit TV; it may be disseminated by video cables or microwave links through a school system; it may be sent into the homes connected by video cable to a community antenna television system (CATV); it may be publicly broadcast; it may be recorded on photographic film or magnetic tape so that prints can be used at different times and in different places. Some systems enable students or teachers to select the material they want at a given time. Dial-access systems have been designed for audio and video instruction in which any one of a large set of lectures can be reproduced for individual students (or managers) on demand. (1969)

When these functions are augmented by the computer, a whole new set of opportunities will arise not only for increased interaction among managers at various levels and locations but also for individual tailoring of the learning process by students, teachers, and managers. The proliferation of aids will create new risks and consume a growing share of a limited budget. Managerial skills will be sorely tested by the impending task of reshaping the educational system and its information-dependent services.

33

Application Of MIS Tools to Education

As the educational manager more seriously considers incorporating MIS* tools into the educational system, he is experiencing many problems that were faced by military and industrial managers in applying the same tools during the past two decades (Bushnell 1964, Bushnell and Allen 1967, Caffrey and Mosmann 1967, Goode and Machol 1957, Goodlad et al. 1966, Loughary 1966, and Rosove 1967).

The developing trend of applying MIS tools to the educational system is quite similar to the past trend of applying MIS tools to industry (Booze, Allen and Hamilton, Inc. 1966 and 1968, Brady 1967, The

* Closely associated with current MIS tools is another set of techniques called *management science* (MS) tools. Although a complete discussion of MS tools lies outside the scope of this paper, their contribution to MIS applications should be understood.

MS techniques derive primarily from mathematics and economics and are intended to aid the solution of managerial problems. The computations involved in using the techniques do not depend on the use of computers, though in some cases they are made economically feasible by computer assistance. In contrast, MIS tools

Diebold Group, Inc. 1967, and Hertz 1969). As in industry, most early educational applications have been made at the lower or operational control level where the decision-making and instructional functions are easiest to perform with the use of computers. Few applications to date have attempted to assist top-level (strategic planning) managers, whose problems are usually highly unstructured and more complex.

A supplement to the bibliography cites literature specifically concerned with applications of MIS tools to education. Based on a survey of this literature, in this chapter I discuss the characteristics, limitations, costs, and extent of the penetration of these applications and identify several important problems that educators must overcome to reduce the risks and costs associated with applying MIS tools to education.

Applications According to Management Levels and Functions

For assistance in analyzing the extent to which applications of MIS tools have penetrated the educational system, I have constructed figure 18. The figure interrelates three classification schemes with the purpose of examining the applicability of MIS tools, first, to levels of management and, second, to management functions *regardless* of level.

In the first column of the figure, Besel's taxonomy (1967) is used to define generally the activities to which MIS tools have applicability. This taxonomy is then cross-referenced with Anthony's classification of management levels and with Evans' classification of basic MIS-supportable functional areas. Anthony's scheme (columns 2, 3, and 4) permits us to determine at what management levels and to what degree—developmental (D) or successfully operational (O)—MIS tools can be or are used to support the activities identified by Besel. A basic assumption made is that, within the educational system, the activities defined in the taxonomy are carried out at the management levels defined by Anthony.

Evans' scheme identifies six major management functions (X) that are potentially supportable by MIS tools. By examining the relative

are practically synonymous with computers because of their exclusive dependence on the latter for the management of data.

In some kinds of applications this distinction between the two sets of tools will increasingly lose its significance during the 1970s, and in fact they will become increasingly interdependent. The combination of MIS and MS techniques into joint "application packages" will be the result of significant breakthroughs in the use of each kind of tool. The growth of MIS capabilities, especially the more recent standardized application packages (Head 1968) that facilitate use of combined computer (MIS) and MS tools, will accelerate management demands for the new kind of power provided by this combination (Churchman et al. 1957 and Hertz 1969). In the remainder of this paper, I discuss applications that reflect the impact these combined tools will increasingly have on education in the 1970s.

FIGURE 18

MIS APPLICATIONS: STATE OF THE ART 1970

Besel's Taxonomy	*Anthony*: Strategic Planning Level	*Anthony*: Mgt. Control Level	*Anthony*: Oper. Control Level	*Evans* MIS-Supportable Functions/Level: Needs Assessment	Resource Mgt. (Finance & Personnel)	Logistics	Planning	Oper. Control	Evaluation
A. Computer-assisted instruction (CAI)									
1. computer-controlled instruction (on-line)		D	D		X			X	
2. computer off-line instruction assistance		O	O		X			X	X
3. computer science education		D	D		X	X		X	
B. Administration									
1. business office data processing		D	O		X	X		X	X
2. scheduling and sectioning of classes (or work)		O	O				X	X	
3. student data processing			O					X	X
4. bus scheduling			D		X	X		X	
5. teacher assignment		D			X			X	
6. simulation of school operations	D	D	D				X		X
7. policy formation	D	D		X			X		
C. Pupil personnel services									
1. computer-assisted counseling			D					X	X
2. pupil transcripts and college admissions		D	O	X	X		X		
3. the computer as a study tool			D					X	
D. Management personnel services									
1. job placement and change		D	O	X	X		X		
2. information services	D	D	O	X	X	X	X	X	X
E. Computerized libraries	D	D	D	X			X		
F. Computers and research			D				X		

Key: D=Applicable MIS tools are in developmental stage.
O=Applicable MIS tools are succesfully operational.
X=MIS tools are potentially capable of supporting this function.

distribution of applications among these functions, we can draw certain conclusions about the nature of these applications and about the kinds of management information needs met by the applications. Although exceptions to the trends indicated in the figure can be found, most applications do fit these categories.

From the distribution of applications in columns 2, 3, and 4, we see that most activity is taking place at the operational control level, where problems tend to be more easily defined, less complex, and more easily structurable. Significant penetration has also occurred at the management control level, but only a few inroads have been made at the strategic planning level. At all levels most applications are still in the developmental stage. Of those operating successfully, the majority by far are at the operational control level.

Of the six management functions identified in the remaining columns—needs assessment, resource management, logistics, planning, operational control, and evaluation—the data indicate that most applications provide assistance in resource management and operational control. Here, again, the greatest number of applications have been developed for those managerial functions where problems are least complex and most structured. Unfortunately, the other functions that are relatively untouched by MIS applications are exactly those that could benefit most from application of these tools. What the overall figure indicates, therefore, is that the computer and its accompanying technology are not being used to perform the most important functions at *any* level of the management hierarchy.

Applications of MIS tools to needs assessment, planning, and evaluation have been retarded for several reasons. Besides their complexity, which adds to the difficulty of identifying the *real* problem, the decisions associated with these managerial functions often require data that are either unavailable or too costly for any one school district to collect and maintain (e.g., demographic data and data required to determine the costs and benefits of educational programs.) *

However, the most fundamental reason why these functions are not being computer-aided lies outside technology: Effective needs assessment, planning, and evaluation can only be undertaken after goals and objectives have been clearly identified. Goodlad, O'Toole, and Tyler have stated:

* An earlier survey by Grant (1967) supports this conclusion. Grant noted that school information systems do not regularly gather information on the products of a school's efforts. However, first steps toward obtaining such information are being taken. The development of educational planning-programming-budgeting systems should accelerate this trend.

> The most formidable block to progress in educational applications of EDP is not the state of the data processing art but an understanding of education as it presently operates and is likely to advance, especially our insight into the relationship between the human beings involved and the vast accumulation of organizational, instructional, and various ad hoc techniques that presently constitute our education system. (1966)

Nevertheless, some progress in satisfying the information-support needs of these functions is being made. Policy-formulation aids, such as budget simulations and forecasting tools, are in advanced stages of development. Ambitious attempts are also being made to simulate entire school operations (Simon 1965 and Sisson 1967). If achieved, such simulations will not only provide improved tools to assist the needs assessment, planning, and evaluation processes, but will create important new tools for top and middle management.

Simulation as a tool has sufficient flexibility to be of potential usefulness to higher as well as lower level management. However, if industrial and military experience is a relevant guide, model realism and data availability problems will plague the more ambitious model-building attempts for some years to come.

Limitations to MIS Applications

Analysis of the complex forces that shape the development of specific types of MIS applications lies beyond the scope of this paper. However, by examining some of the major limitations that have hindered the development of MIS applications, the reasons certain types of them have evolved can be more clearly understood. Four major limitations, highly interrelated in their effects, are as follows:

- data management software state of the art
- data availability and model relevance
- problem definition
- educational management team involvement

DATA MANAGEMENT SOFTWARE

The software required for an MIS tool can be characterized according to the number of files needed (one versus many) and the updating requirements (slow versus fast or on-line). Figure 19 is a means of classifying the kinds of software applications according to these criteria. Each quadrant of the figure represents a particular kind of application as determined by the number of files and the speed of updating required. Examples of the types of files used in the applications are cited. The heading of each quadrant (remote batch, etc.) indicates the common type of information support system associated with that application.

FIGURE 19

TYPES OF DATA MANAGEMENT SOFTWARE
ACCORDING TO SPEED OF UPDATING AND NUMBER OF FILES REQUIRED

Updating Requirements	One	Many
Slow	Remote Batch e.g. Census or poll file	Information Storage and Retrieval e.g. Library files
	Major Problems Availability of statistical packages Validity of inputs	Major Problems Library management Cataloging Retrieval Cross-referencing
	Dedicated Time-Sharing e.g. Personnel file Accounting file Reservations file	Computer Utility e.g. Many unrelated work files
Fast	Major Problem Updating, purging	Major Problem Keeping track of disparate items of information

Number of Files

Source: De Sola Pool et al. (1969)

One or several unique data-management problems confront each kind of software application. The most important of these problems are listed below the broken lines that divide each quadrant. The complexity of these problems is directly proportional to the number of files and the speed of updating required by the application.

MIS tools (i.e., programs) needing only a single file and not requiring rapid updating as change data become available (upper left quadrant) are well within the state of the art and can be accommodated by most of today's batch or remote batch information support systems. The risks involved in applying tools of this type are low—both technologically and economically.

Of greater risk, but still achievable, are the newer time-sharing systems (lower left) that can rapidly update single files when information retrieval requests are well specified.

More advanced MIS capabilities can assist in the solution of the classic information problems cited in the upper right quadrant. MIS techniques will contribute heavily to the library of the future in helping to solve problems of this type. Beyond the present state of the art are those MIS tools (lower right) that require the use of a number of files, some of which must be rapidly updated for a variety of uses.

DATA AVAILABILITY AND MODEL RELEVANCE

Even if an MIS tool can be easily accommodated by present software capabilities, it faces two additional limitations: availability of necessary data and existence of relevant models.

Since data are the most important ingredient of a management information system, their availability critically determines the feasibility of using an MIS tool. Data used to support decision making at the school district level can be roughly divided into *internal* data and *external* data. Whereas internal data can usually be acquired with varying expense and difficulty by the district's own reporting system, most kinds of external data can be obtained only through statewide or nationwide information services that are either not yet developed or not equipped to provide reliable service at a reasonable cost (see *time sharing*, chapter 32). Lacking an effective nationwide data base, many applications of MIS tools—e.g., the comparison of one school district with others on a variety of performance measures—are difficult or impossible to achieve.

Another distinction can be made concerning the time period addressed by MIS tools at the school district level. On the one hand, MIS tools and technology can be used to evaluate the *past* performance of any aspect of the district's operations. On the other hand, MIS tools can be combined with models and other simulation aids to project the *future* operations of the district. However, a severe limitation on this latter type of application is the lack of relevant computer models to assist management in planning these future operations. This limitation is especially critical because some of the most important management decisions are those that would involve model-aided planning.

Figure 20 shows how the limitations of data availability and model relevance combine to affect the success of applications of MIS tools. Each quadrant of the figure assesses the prospects for successfully applying MIS tools, as determined by the scope of the data base and the time period addressed. In the lower left quadrant, where locally gathered data are used and planning models are not required for decisions, prospects for successful application of MIS tools are excellent. Although the type of activity identified in the upper left quadrant similarly focuses on

Figure 20
Data Availability and Model Relevance

Scope of Data Base	Analyzing Past Operations	Planning Future Operations	
External Data	**GOOD** Example Analysis of student verbal abilities—nationwide Major problem Dependent upon national MIS network capabilities	**POOR** Example Location and design of new school building; enrollment forecasting Major problem MS* (e.g., simulation and forecasting) tools not developed	*Strategic Planning* *Management Control*
Internal Data	**EXCELLENT** Example Analysis of student verbal abilities—locally Major problem None except for data management software limitations	**FAIR** Example Preparation of next year's class schedule or budget Major problem MS* (e.g., simulation) tools must be tailored/developed for local school system for easy use at reasonable cost	*Management Control* *Operational Control*

Time Period Addressed

* See footnote at beginning of chapter

only past operations and thus does not require planning models, the applicable MIS tools that could support the decision-making process enjoy only good prospects for successful application. Here the problem concerns not so much technology as cost and difficulty in collecting data.

The examples of managerial activities shown in both right-hand quadrants could benefit from models (e.g., simulation aids) to project future operations of the schools before decisions can be made. Prospects are fair for successful application of MIS tools to the type of activity shown in the lower right quadrant, because a complex although structurable decision-making process is involved. However, even if relevant simulation tools are available, they are not yet developed sufficiently to be inexpensively and easily used at the local school level. Prospects for successful application of MIS tools to the activities shown in the upper right quadrant are poor because, in addition to requiring difficult-to-obtain data, they depend on the use of simulation and forecasting tools not yet developed for operational use (Sisson 1967).

To the right of the figure, the three levels of the decision-making process are correlated with the scope of the data base and staggered to indicate increasing concern with future time periods. As a general rule, decisions at the operational control level require mainly internal data, decisions at the management control level require both internal and external data, and decisions at the strategic planning level require mainly external data. Significantly, the data availability limitation is most acute at the strategic planning level—where management is most in need of the assistance that MIS tools can potentially provide and where the MIS tools require relevant data to provide support.

PROBLEM DEFINITION

Another serious limitation confronting use of MIS tools concerns man's inability to define the problem. Inadequate problem definition is probably the major cause of the costly failures in applying computers to military and industrial decision making (Evans 1967 and 1968 and Rosove 1967).

Problem definition is related to how simple or complex and how structured or unstructured the problem is. *Simple* problems involve few variables and few interrelationships among variables. *Complex* problems involve many variables that have a large number of interrelationships (Morton 1967). *Structured* problems are those whose dimensions and variables, as well as the cause and effect relationships among these variables, are well known. *Unstructured* problems, on the other hand, have

variables that are not clear and whose relationships are not understood, even in probabilistic terms. In short, such problems require the analyst to exercise a great deal of judgment in devising solution strategies.

Figure 21 illustrates educational problems in terms of the above four categories (Evans 1968 and Evans and Likert in press) by providing examples of such problems (and associated MIS tools) commonly faced by educational managers at various levels. MIS tools have affected these problems differently, the most successful and general impact being on those problems that are simple and structured (Head 1968). Some significant impact is also being made on complex and structured problems (e.g., student scheduling and budget planning). However, in the unstructured areas, both simple and complex, the major impact of the computer (MIS) has been only to update and enlarge the scope of the data base. The ability of the computer directly to aid decision making where problems are unstructured has been largely untapped. However, interactive "browsing" capabilities (i.e., convenient man-machine aids for searching the data base from a remote terminal) should, in the future, allow managers to do a better job of defining some of these problems.

In short, as problems become less simple and less well structured—i.e.,

FIGURE 21

MAJOR CATEGORIES OF PROBLEMS AND THEIR ABILITY TO BE DEFINED AND AIDED

	Structured	*Unstructured*	
Complex	SOME Student scheduling Budget planning Basic MIS capability—simulation aids, cost-effectiveness, PERT	POOR K-12 curriculum planning Organizational renewal Basic MIS capabilities—systems analysis, PPBS	↑ *Strategic Planning* ↑↓ *Management Control*
Simple	EXCELLENT Simple accounting functions e.g., accounts receivable, accounts payable, and payroll Basic MIS capability—application package	SOME Student counseling Inventory control Basic MIS capability—interactive capabilities	↑↓ *Operational Control* ↓

as we ascend the management hierarchy into the middle and upper levels —the risk increases that either inappropriate or unnecessarily sophisticated MIS tools will be applied (Evans in press) when attention instead should be given to finding the right problems to be solved. The most difficult of the complex and unstructured problems is that of characterizing the educational system. Once that task is more substantially under way, more relevant MIS tool tailoring and building can proceed.

EDUCATIONAL MANAGEMENT TEAM INVOLVEMENT

The largest risks and costs in terms of wasted financial resources, management time and effort, and MIS tool development will surely be incurred if the educational managers at *all* levels are not substantively involved in leading the effort to reshape and renew the educational system. The risks and costs of the previously discussed limitations are largely contingent on the resolution of this one.

As we have seen, the more complex and unstructured problems—those with a large number of variables whose interrelationships are constantly changing and imperfectly understood—remain to be identified and characterized with the aid of computer- and noncomputer-generated* data. Decisions on what information should be collected through costly MIS networks and MIS models must be made by the accountable educational management team. Additional decisions of rapidly increasing significance concern the design and choice of a computer-based MIS and/or MIS services. These decisions have many subtle consequences related to the redistribution of power and knowledge throughout the school system and the community, and thus require active leadership and involvement by educational management.

Goodlad, O'Toole, and Tyler confirm the growing fear that inadequate involvement of educational managers will lead to the misapplication of MIS tools (as was the case in the military and in industry in the 1950s and 1960s):

> As we move today toward individualized programs facilitated by new patterns of school organization and comprehensive packages of instructional materials, the pupil diagnoses and prescriptions called for demand new data and more sophisticated use of them. Most teachers have not yet either perceived or been prepared for the kinds of decisions that they will increasingly be called upon to make. Furthermore,

* Some MIS technologists and managers are prone to view all managerial problems as simply a need for a larger computer data base. This "data base myopia" frequently leads to overreliance on computer-based quantitative data as opposed to analysis of external noncomputer-based data (Evans in press) with emphasis on various "subtle factors" (Harman 1968).

they usually do not yet see the inherent possibilities of the many items of information now available. It is imperative, therefore, that educators stay very close to the tasks of defining, collecting, and providing the data needed. Otherwise, EDP personnel are likely to develop systems that perpetuate the provision of data pertinent to the relatively routine educational tasks of the past but inappropriate to the sensitive educational decisions of the future. (1966)

Gaps Constraining Development and Use of MIS Aids

Before MIS tools can be developed and used at their potential, various professional groups must cooperate to close several important gaps in research and development. Figure 22 summarizes these gaps, identifies the main professional and management groups responsible for their closure, and correlates the gaps with the major limitations just discussed.

An important insight obtained from the figure is the paramount importance of improving the ability to define problems. As the figure shows, the problem-definition limitation is related to *all* the major gaps. Therefore, attention must be given to developing improved problem-definition methodologies (Evans 1968 and Pounds 1965) and to developing MIS needs-assessment capabilities. Unfortunately, MIS technology and tools (i.e., problem-*solving* tools) frequently are developed and applied quite independently of any assessment of educational needs or clear definition of a problem.

The growing "shopping list" of innovative practices and tools is displayed in figure 23. On the left side of the figure are the disciplines that contributed the innovations and from which managers can obtain additional resources in applying MIS tools.

The overall goal of educational managers should be the three-fold renewal of their individual skills (Gardner 1964), the management system (Likert 1967), and educational organizations (Bennis 1966). However, before marshalling the appropriate human, technological, and organizational resources to achieve this goal, they must first more clearly perceive and define relevant problems.

FIGURE 22

GAPS CONSTRAINING DEVELOPMENT AND EFFECTIVE USE OF MIS AIDS

		Limitations			
		Data Mgt. Software	*Data Avail. & Model Rel.*	*Problem Definition*	*Mgt. Involvement*
Managerial Emphasis (Educational managers, planners, and training personnel)	New skills development Self-renewal problem			X	X
	Management system renewal Collective incentive problem			X	X
	Goals and their interrelationships Identification, clarification, and implementation problem			X	X
	Design and control of new federations Synergetic problem			X	X
Analytical Emphasis (Systems analysts, information scientists, and behavioral scientists)	Organizational system analysis Methodology and "tool-tailoring" problem	X	X	X	
	Test and evaluation Option-selection problem: federation innovation terminal } MIS tools service } MS tools	X	X	X	
Combined Emphasis	MIS aids implementation Lessons learned problem	X	X	X	X

FIGURE 23

MASTER "SHOPPING LIST" OF MIS PRACTICES AND TOOLS

DISCIPLINES	CONTRIBUTIONS				
Information Technology	Calculators	Slide Rule	Punched Card Equipment	Service Bureau Time-Sharing	Distributed Configurations
				CAI	
Educational Technology	Blackboard	Projectors	AV	Closed-Circuit TV	Multi-Media Center
				Experimental Schools	
Educational Practices	Tutoring	"Standard" Classroom Practices	Differentiated Staffing	Team Teaching	New Tradition "Zero Reject"
				Accountability	
Management Practices	Authoritative		"Theory Y" Incentives	Project/Matrix Organizations	Participative
	WORK SIMPLIFICATION			PPBS	
Analytical Concepts & Techniques	Scientific Method	Operations Research	Systems Analysis	Man/Machine Simulation Modeling	

34

Computing the Future

THE opening paragraphs of this paper contained both a promise and a note of caution for educational managers who are or will be using the new tools created by advancing technology. The promise is implicit in the growing opportunities provided by these tools for increasing flexibility in education. On the other hand, the risks and costs associated with these tools require educators to treat them with caution—as Kappel warned, "to use our heads" (in Withington 1966).

I deferred explanation of the opportunities and the risks to define, first, in chapter 31, some basic concepts. The most important concept considered was a systems view of the decision-making process as a multi-level, hierarchically structured system of interrelated activities. With the aid of this framework I was able to differentiate generally among both the decisions made at various levels and the types of information required to support those decisions. A perspective was thus provided for understanding how MIS technology, including management science tools, can be used as aids to the decision-making process.

The nature of the promise was more specifically defined in chapter 32,

where I highlighted landmark MIS-related technological developments and suggested some implications of these developments for educational managers. The risks associated with the use of MIS tools formed the theme of chapter 33. There I characterized the extent to which MIS applications have penetrated the management hierarchy and discussed some of the major limitations and gaps that shape their development and inhibit their use.

With these previous chapters providing a context and a perspective, I will now summarize the more likely future developments in MIS technology and its effects on education. First, I will discuss some basic changes in the educational system and in management requirements. Second, I will review some of the MIS developments, already on the horizon, that are included among the growing spectrum of options available to the educational manager. This proliferation of options offers great promise for effectively renewing the educational system, yet the problem of selecting from among these options implies significant risks that can and should be reduced. Finally, I will present some broad implications associated with the development and use of MIS tools.

Changing Requirements for the Educational System And Its Managers

The accelerating pace of technological change and other major long-term trends are having an increasingly profound impact on the way the educational system is organized and on the role played by its managers (Rosove 1968). MIS technology is creating unprecedented opportunities to manage and distribute information—hierarchically and geographically—to a place and at a time convenient to both manager and learner. These new opportunities will create pressures to organize and deliver educational services in ways vastly different from those practiced in the past (Silberman 1966 and "Reading, Writing and Profit" 1969).

Once the manager receives the new MIS tools for his own use, he will be encouraged and required both to learn new roles (e.g., learning facilitator) and to develop new skills (e.g., cognitive and greater interpersonal abilities). The overall result of all these developments will be a much more participative style of management (Evans and Likert in press) so as to facilitate learning throughout the lifetimes of managers and students alike.

The trend toward lifetime learning is inevitable because of the substantial and constant changes in job requirements both inside and outside the educational system (Lessing 1967). The impact of information technology on educational occupations is particularly significant. Of fifty

types of new roles predicted by Rosove (1968), approximately twenty will be directly spawned by this technology.

Another predictable trend is the increasingly systematic approach to solving problems. Characteristics of the new approach are as follows:

> 1) A more open and deliberate attention to the selection of ends toward which planned action is directed, and an effort to improve planning by sharpening the definition of ends.
>
> 2) A more systematic advance comparison of means by criteria derived from the ends selected.
>
> 3) A more candid and effective assessment of results, usually including a system of keeping track of progress toward interim goals. Along with this goes a "market-like" sensitivity to changing values and evolving ends.
>
> 4) An effort, often intellectually strenuous, to mobilize science and other specialized knowledge into a flexible framework of information and decision so that specific responsibilities can be assigned to the points of greatest competence.
>
> 5) An emphasis on information, prediction, and persuasion, rather than on coercive or authoritarian power, as the main agents of coordinating the separate elements of an effort.
>
> 6) An increased capability of predicting the combined effect of several lines of simultaneous action on one another; this can modify policy so as to reduce unwanted consequences or it can generate other *lines* of action to correct or compensate for such predicted consequences. (Ways 1967)

Education is no exception to this emerging trend (Lessinger 1969, "Reading, Writing and Profit" 1969, and USOE Bureau of Elementary and Secondary Education 1970). Lessinger, for example, has stated:

> First, local educational agencies must develop the capacity to renew themselves and to be more responsive to the changing needs of their clientele. They have demonstrated success in expansion and elaboration of existing programs in response to national concerns but need to develop the capacity to *manage the problems of continuous renewal and flexibility*. This implies the development of a new kind of educational management that concurrently (a) involves clientele in the definition of needs and policies, (b) brings real authority to bear upon the solution of problems and (c) institutionalizes change. (Emphasis added)
>
> Second, schools must accept the principle of 'accountability' for student performance. Extension or expansion of services by local and State agencies is laudable but inadequate: They must be accountable for the learning *results* they produce with public funds. Schools for too long have operated as public monopolies and have been able to avoid the consequences of poor or mediocre performance. Student unrest is merely one consequence of these inadequacies. (1969)

In this dynamically changing educational environment, the educational manager will have countless opportunities to augment his present skills, to increase his array of decision-making tools, and to expand his organizational affiliations. His effectiveness as a manager will depend largely on his ability to identify his information needs. The effectiveness of his MIS will in turn depend largely on both the number of MIS tools and services available and on his ability to specify, combine, and select those best suited to his information needs.

Trends in MIS Technology

What will computer technology offer the educational manager in hardware and software options during the next five years? A partial answer is presented in figure 24 where hardware and software capabilities that will characterize the fourth and fifth computer generations are summarized (Andahl and Andahl 1967, Doelling 1968, Gosden 1969, Hobb 1966, Opler 1967, and "The Next Generation" 1967).

Major hardware trends are highlighted by the growth and diversity of computer families (e.g., the IBM/360 series illustrated in figure 7) and by the "explosion" of terminal options. The growing variety of MIS terminals enables the educational manager to be highly selective in acquiring terminals tailored to his particular activities, whether simple or complex.

Regarding software, a growing range of new languages, operating systems, data-management systems, and industry-oriented application packages are becoming available for use in addressing at least the simple, well-structured management problems (see figure 21). Of even greater importance is the fact that the new capabilities and services will increasingly be provided by a rapidly growing number of "outside" information-handling specialists ("When EDP Goes Back to the Experts" 1969).

DATA-MANAGEMENT-SUPPORT SYSTEMS

These hardware and software components can be combined in almost unlimited ways to provide a range of small-to-large data-management-support systems. The basic nature and characteristics of these systems are shown in figure 25. The widely differing capabilities, risks, delivery times, and costs associated with these support systems strikingly underline the importance of carefully defining problems and information requirements.

The products generated by various technologies and disciplines were shown earlier in figure 23. This "shopping list" represents a bewildering array of practices, skills, services, and MIS tools that can be brought to

bear on particular management and learning problems. Since some of the key disciplines that have contributed or will contribute these aids lie mostly outside the educational system, the paramount management task is to identify and structure the right mixture of these aids and to organize them to address particular problems.

FIGURE 24

PROJECTED FIVE-YEAR TRENDS IN HARDWARE/SOFTWARE TECHNOLOGY: TOWARD THE FOURTH AND FIFTH GENERATIONS

Hardware

Computer families
- from intra- to intersystem compatibility
- larger, complex computers (e.g., central facility)
- small job/communications controller computers (e.g., distributed data processing)
- small "free standing" computers (i.e., dedicated time-sharing services)
- special applications-oriented mini- and microcomputers

Cheaper, high speed, high capacity storage (e.g., "magnetic bubble" technology)

Batch fabrication and large-scale integration logic (LSI) for cheaper, faster power

New data communications products (made economical through use of time-shared, broadband channels)

Terminal option "explosion"
- data phones, picture phones
- TV/CRT/CATV display devices
- graphic capabilities
- voice capabilities
- "firmware" capabilities
- audio/TV tape recording devices
- simplified key boards

Software

New languages
- higher level, problem-oriented languages (e.g., "first financial language")
- general purpose programming languages (e.g., PL/I, PL/II)
- user conversational languages (e.g., BASIC)
- user level-of-skill aids (novice-tutorial; journeyman-multiple choice)
- data description languages for intersystem compatibility

New operating systems to handle diverse jobs in multiple modes of operation (i.e., real time, remote batch, interaction modes)
- multiprogramming
- multiprocessing
- various time-sharing scheduling schemes
- microprogramming

General data-management systems

Generalized application packages
- industry and problem oriented (e.g., bank industry-payroll)

New software businesses and services
- different modes of operation
- industry oriented
- national networks
- cooperative services
- automatic data exchange

FIGURE 25

NATURE AND CHARACTERISTICS OF ALTERNATIVE DATA-MANAGEMENT-SUPPORT SYSTEMS

"Small" —————— "Medium" —————— "Large"

Basic Nature		Time-shared (Medium to Large); Real-time; On-line; Nonconversational / Semiconversational / Conversational	
		Batch—Remote Batch—Multiprogrammed—Enquiry—Dedicated Time Sharing — General Time Sharing and Distributed Data Processing	
Characteristics: Performance	Responsiveness	Low (hours, days) →	High (seconds, minutes)
	Capacity	Small storage →	Large storage
	Capability	Specialized to one job type →	Easily tailored to many job types
	Growth Flexibility	Not compatible & fixed configuration →	Upward compatible & modular growth
Risk		Low (off the shelf) →	High (requiring research & development)
Time		Several months to installation →	5-10 years
Development & Investment Cost		$100,000 →	$2,000,000 to $10,000,000

Source: Evans and Campbell (1970)

Prospects for Redistributing Knowledge and Power

For too long the computer has been commonly regarded as simply another, albeit more powerful, calculation device to be used only for routine computational tasks. Now, however, with the proliferation of MIS tools and networks, the computer is emerging as a key agent in the redistribution of knowledge and power.

The most important—but perhaps most subtle—implication of MIS technological developments is that they provide major opportunities for improving not only the quality of education, but also *equal educational opportunity*. As networks begin to link geographically distributed data bases, any manager (or student) in any school district can gain access to information from these sources of knowledge.

Another important trend will be the vertical and horizontal integration of various types of systems related to MIS. As these systems become more integrated, administrators who are now isolated organizationally or geographically from one another will be able to interact more closely in using their MIS aids.

Information—the lifeblood of the management process and the key to survival and continuous renewal of the manager and the educational system—can saturate man's thinking process as easily as its absence can starve that process. The "information explosion" and the improved means for distributing this information can quickly flood the educational manager's desk top and mind with useless data. Fortunately, the manager can avoid this problem by properly defining educational objectives and by understanding the decision-making process as a dynamic, multilevel system. Furthermore, he must construct his MIS with due regard for costs and benefits, and must carefully choose the associated tools with a sensitivity to their limitations.

By the mid-1970s or sooner, the manager will observe that the evolutionary development of information technology that began in the 1950s and continued throughout the 1960s will have accelerated so rapidly as to trigger a dramatic revolution in the acquisition, processing, distribution, and use of information.

> The question is not whether we will incorporate the computer into the solution of the problems of communication, knowledge and power. The question is whether we will guide its development and control its use in the light of human needs and aspirations.
>
> Howard W. Johnson, president
> Massachusetts Institute of Technology

Bibliography

"Airline Reservation Systems." *Datamation*, June 1962.

Alexander, T. "Computers Can't Solve Everything." *Fortune*, October 1969.

"The American Telephone and Telegraph Company's High-Speed and Facsimile System National Network." *Peripherals Weekly*, 20 November 1969.

Andahl, G. N., and Andahl, L. D. "Fourth Generation Hardware." *Datamation*, January 1967.

Anderson, G. E., Jr. "The Computer Utility for Education: Problems and Propects." *Data Processing for Education*, October 1968.

Anthony, Robert N. *Planning and Control Systems: Framework for Analysis.* Cambridge, Massachusetts: Harvard University Press, 1965.

"Assessing Technology." *Science*, 21 November 1969.

Barnard, Chester. *The Functions of the Executive.* Cambridge, Massachusetts: Harvard University Press, 1954.

Baron, P. "The Coming Computer Utility—Laissez Faire Licensing for Regulation?" *Public Interest*, Summer 1967.

Bauer, W. F. "Computer/Communications Systems: Patterns and Prospects." In *Computers and Communications—Toward a Computer Utility*, edited by F. Gruenberger. Englewood Cliffs, New Jersey: Prentice-Hall, 1968.

Bell, David. "The Balance of Knowledge and Power." *Technology Review*, June 1969.

Bennis, Warren G. *Changing Organizations*. New York: McGraw-Hill, 1966.

Bennett, E. M. "Data Entry through Distributed Data Processing." *Journal of Systems Management*, September 1969.

Besel, R. R. *Computers and Education: The State of the Art, 1967.* August 1967.

Bigelow, R. C. "Legal and Security Issues Proposed by Computer Utilities." Paper presented to the American Management Association, 10 March 1967.

Blumberg, D. F. "Information Systems and the Planning Process." *Data Processing Magazine*, May 1965.

Booze, Allen and Hamilton, Inc. "The Computer Comes of Age." *Harvard Business Review*, January-February 1968.

Booze, Allen and Hamilton, Inc. "The Computer's Role in Manufacturing." *Computers and Automation*, December 1966.

Bothwell, P. "Mini Computers: The Mouse That's Just Beginning to Roar." *Forum*, October 1969.

Brady, R. H. "Computers in Top-Level Decision Making." *Harvard Business Review*, July-August 1967.

Brooker, W. M. A. "The Total Systems Myth." *Systems and Procedures Journal*, July-August 1965.

Brown, G. W.; Miller, J. G.; and Keenan, T. A. *An EDUNET Report of the Summer Study on Information Networks*. New York: John Wiley and Sons, 1967.

Bueschel, R. T. "Time-Sharing in the Near Future." *Computers and Automation*, January 1969.

Bueschel, R. T.; Stephenson, A. G.; and Whitney, D. C. *Commercial Time-Sharing Services and Utilities*. New York: American Management Association, 1969.

Burck, G. *The Computer Age*. New York: Harper and Row, 1965.

Bushnell, D. D. *The Automation of School Information Systems*. DAVI Monograph Series, no. 1. Washington, D. C.: 1964.

Bushnell, D. D., and Allen, D. W. *The Computer in American Education*. New York: John Wiley and Sons, 1967.

"Cable TV Leaps into the Big Time." *Business Week*, 22 November 1969.

Caffrey, J., and Mosmann, C. J. *Computers on the Campus: A Report to the President on Their Use and Management*. Washington, D. C.: American Council on Education, 1967.

Canning, R. G., ed. "Advances in Fast Response Systems." *EDP Analyzer*, February 1967.

Canning, R. G., ed. "A New Look at Management Reporting." *EDP Analyzer*, June 1965.

Canning, R. G., ed. "New Management Reporting Systems." *EDP Analyzer*, January 1967.

Canning, R. G., ed. "Software Factors for Remote Terminals." *EDP Analyzer*, May 1969.

Canning, R. G., ed. "Technical Support for a MIS." *EDP Analyzer*, September 1967.

Canning, R. G., ed. "What's the Status of MIS?" *EDP Analyzer*, October 1969.

Carroll, D. C. "Implications of On-Line Real-Time Systems for Managerial

Decision Making." In *The Management of Aerospace Programs*. Science and Technology Series, vol. 12. Tarzana, California: American Astronautical Society, 1967.

Carroll, D. C. "Man/Machine Cooperation in Planning and Control Problems." Paper presented at the International Symposium on Long-Range Planning for Management. Paris: UNESCO, September 1965.

Carver, Fred D., and Sergiovanni, Thomas J., eds. *Organizations and Human Behavior, Focus on Schools*. New York: McGraw-Hill, 1969.

Churchman, C. W.; Arnoff, E. L.; and Ackoff, R. L. *Introduction to Operations Research*. New York: John Wiley and Sons, 1957.

"Community Antennas Enter the Big TV Picture." *Fortune*, August 1965.

"The Computer Utility: Implications for Higher Education." *Datamation*, August 1969.

"COMSAT Urges Own Satellite System." *Electronic News*, 3 November 1969.

Conant, James B. *The American High School Today*. New York: McGraw-Hill, 1959.

Corbato, F. J., and others. "An Experimental Time-Sharing System." In *Proceedings of the Spring Joint Computer Conference*. Washington, D. C.: Spartan Books, 1962.

Davidson, L. "A Push-Button Telephone for Alpha Numeric Input." *Datamation*, 1966.

Dearden, John. "Can Management Information Be Automated?" *Harvard Business Review*, March-April 1964.

Dearden, John, and McFarlen, F. Warren. *Management Information Systems*. Homewood, Illinois.: Richard D. Irwin, 1966.

Desmonde, W. H. *Real-Time Data Processing Systems*. Englewood Cliffs, New Jersey: Prentice-Hall, 1964.

De Sola Pool, Ithiel; MacIntosh, S.; and Griffel, D. "On the Design of Computer-Based Information Systems." Cambridge, Massachusetts: Joint Center for Urban Studies of MIT and Harvard University, February 1969.

Diebold Group, Inc., The. "Research Studies Conclusions." *Computer Digest*, August 1967.

Diebold, John. "Goals to Match Our Means." In *The Social Impact of Cybernetics*. Notre Dame, Indiana: University of Notre Dame Press, 1966.

Diebold, John. *Man and the Computer*. New York: F. A. Praeger, 1969.

Doelling, N. "Computer Resources Sharing—Some Comments and Predictions." *Computers and Automation*, October 1968.

Drucker, Peter. *The Age of Discontinuity*. New York: Harper and Row, 1968.

Drucker, Peter. *Landmarks of Tomorrow*. New York: Harper and Row, 1959.

Drucker, Peter. *The Practice of Management*. New York: Harper and Row, 1954.

"85,000 Computers by 1975; Operation Cost to Drop." *Administrative Management*, June 1966.

Elliott, C. O., and Wasley, R. S. *Business Information Processing Systems.* Homewood, Illinois: Richard D. Irwin, 1965.

Evans, John A. "Comments on Software Design for an Operating Management Decision System Based on Linear Programming." In *Management Information Systems: Progress and Perspectives*, edited by C. H. Kriebel and R. L. Van Horn. Proceedings of a Research Symposium held at Carnegie-Mellon University, Pittsburgh, June 1968, forthcoming.

Evans, John A. "A Methodology for Command Information System Analysis." In *Information System Science and Technology*, edited by D. E. Walker. Washington, D. C.: Thompson Book Co., 1967.

Evans, John A. *The Role of Systems Analysis in Educational Management.* Bedford, Massachusetts: The MITRE Corporation, Report no. M68-11, June 1968.

Evans, John A., and Campbell, R. U. D. "The Structuring of Health Information System Options: Summary and Assessment of Methodology." *Socio-economic Planning Sciences*, April 1970.

Evans, John A., and Likert, R. "Problem-Finding Aids for Manager and Management System Development." *Educational Technology*, forthcoming.

Everett, R. R.; Zraket, C. A.; and Bennington, H. D. "SAGE, A Data Processing System for Air Defense." In *Proceedings of the Fall Joint Computer Conference.* Washington, D. C.: Spartan Books, December 1965.

Federal Communications Commission. *Interdependence of Computer and Communication Services and Facilities.* Washington, D. C.: FCC Docket no. 16979, 10 November 1966.

Fine, G. H.; Jackson, C. W.; and McIsaacs, D. V. "Dynamic Program Behavior under Paging." In *Proceedings of the Spring Joint Computer Conference.* Washington, D. C.: Thompson Book Co., 1967.

"The First Grant in a Program to Determine the Value and Cost to Educational Institutions of Sharing Computers and Related Activities." *EDP Weekly*, 1 April 1968.

Forrester, Jay. *Industrial Dynamics.* Cambridge, Massachusetts: MIT Press, 1961.

Gardner, John W. *Self-Renewal.* New York: Harper and Row, 1964.

"GE Announces $34 Million Investment to Implement Nation-Wide Network for 'RAIR' and Other On-Line Services." *EDP Industry Report*, 17 June 1969.

Ginsburg, M. G. "Notes on Test Real-Time Systems." *IBM Systems Journal*, vol. 4, no. 1, 1965.

Glaser, E. L., and Corbato, F. J. "Introduction to Time-Sharing." *Datamation*, November 1964.

Goode, H. H., and Machol, R. E. *System Engineering: An Introduction to the Design of Large-Scale Systems.* New York: McGraw-Hill, 1957.

Goodlad, J. L.; O'Toole, J. F., Jr.; and Tyler, L. L. *Computers and Information Systems in Education.* New York: Harcourt, Brace and World, 1966.

Gosden, J. "The New Role of Management Information Systems." Washington, D. C.: The MITRE Corporation, Report no. MTP-332, April 1969.

Grant, C. B. S. "Educational Technology in the Nation's High Schools: A Status Report." *Data Processing Magazine*, vol. 9, no. 8, 1967.

Greenberger, M. "The Computer of Tomorrow." *Atlantic Monthly*, July 1964.

Gruenberger, F. "Are Free-Standing Computers Here to Stay?" *Datamation*, April 1966.

Harman, W. W. *Notes on Anticipating the Future*. Stanford, California: Educational Policy Research Center, Stanford Research Institute, 1968.

Head, R. V. "Management Information Systems: A Critical Appraisal." *Datamation*, May 1967.

Head, R. V. "Software Package Acquisition." *Datamation*, October 1968.

Head, R. V. "The Software Explosion." *Business Automation*, September 1968.

Hertz, David B. *New Power for Management*. New York: McGraw-Hill, 1969.

Hext, J. B. "Recovery from Error." *Computers and Automation*, April 1967.

Hittel, L. A. "Some Problems in Data Communications between the User and the Computer." In *Proceedings of the Fall Joint Computer Conference*. Washington, D. C.: Spartan Books, 1966.

Hobb, L. C. "The Impact of Hardware in the 1970s." *Datamation*, March 1966.

"How Computers Are Changing Your Life." *U.S. News and World Report*, 10 November 1969.

Hunt, P. "The Fallacy of One Big Brain." *Harvard Business Review*, July-August 1966.

Irwin, M. P. "The Computer Utility." *Datamation*, November 1966.

"Is the EDP Department Headed for Oblivion?" *Computer Digest*, August 1969.

Jequier, N. "Computer Industry Gaps." *Science and Technology*, September 1969.

Joseph, E. C. "Coming Age of Management Information Systems." *Financial Executive*, August 1969.

Kalish, J. A. "Flim Flam, Double Talk and Hussle: The Urban-Problems Industry." *Washington Monthly*, November 1969.

Kimball, G. L. R., Jr. "A Time-Sharing Bibliography." *Computing Reviews*, May 1968.

Koontz, Harold. "The Management Theory Jungle." *Journal of the Academy of Management*, December 1961.

Lee, M. J. "The Demise of the Keypunch." *Datamation*, March 1968.

Lessing, L. "Where the Industries of the Seventies Will Come From." *Fortune*, January 1967.

Lessinger, L. M. "Lessinger Calls for Improved School Management." *Education Daily*, 30 September 1969.

Licklider, J. C. R. "Man/Computer Partnership." *International Science and Technology*, May 1965.

Licklider, J. C. R. "Man/Computer Symbiosis: How I Read." *IRE Transac-*

tions on Human Factors in Electronics, vol. HFE-1, no. 1, March 1960.

Likert, R. *The Human Organization.* New York: McGraw-Hill, 1967.

Loughary, J. W. *Man/Machine Systems and Education.* New York: Harper and Row, 1966.

McCammy, James L. "An Analysis of the Process of Decision Making." *Public Administration Review*, vol. 7, no. 1, 1947.

McCarthy, J. "Time-Sharing Computer Systems." In *Management and the Computer of the Future*, edited by M. Greenberger. Cambridge, Massachusetts: MIT Press, 1961.

McFarland, Robert L. "Electronic Power Grab." *Business Automation*, February 1965.

McLuhan, Marshall. *The Medium Is the Massage.* From his movie.

Morton, M. S. S. "Interactive Visual Display Systems and Management Problem Solving." *Industrial Management Review*, Fall 1967.

"A New Industry's Wild Ride." *Business Week*, 24 May 1969.

Newman, William H. *Administrative Action, the Techniques of Organizational Management.* New York: Prentice-Hall, 1964.

"The Next Generation." *Datamation*, January 1967.

Nuthmann, C. *Computerized Television Communications.* Bedford, Massachusetts: The MITRE Corporation, Report no. M69-60, September 1969.

Nuthmann, C. *On the Feasibility of a 10,000 Terminal Time-Shared Interactive Computer Control Educational Television (TICCET) System.* Washington, D.C.: The MITRE Corporation, Report no. MTP-317, May 1969.

Oettinger, Anthony G. *Run Computer Run: The Mythology of Educational Innovation.* Cambridge, Massachusetts: Harvard University Press, 1969.

Opler, A. "Fourth Generation Software." *Datamation*, January 1967.

Overhage, C. F. J. "Information Network and Review of Information Science and Technology." In *Annual Review of Information Science and Technology*, vol. 4, edited by C. A. Cuadra. Chicago: William Benton, Publisher, 1969.

Parker, R. W. "The SABRE System." *Datamation*, September 1965.

Parkhill, D. S. *The Challenge of the Computer Utility.* Reading, Massachusetts: Addison-Wesley Publishing Co., 1966.

Parsons, Talcott. *Instruction and Process in Modern Societies.* Glencoe, Illinois: The Free Press, 1960.

Peck, T. A. "The Future of Desk Top Computers." *Data Processing Magazine*, March 1968.

"Potential Resources for EIN." *EDUCOM*, November 1968.

Pounds, W. F. *The Process of Problem Finding.* Cambridge, Massachusetts: MIT Press, Report no. WP 14765, 1965.

"RCA Puts TV in Packs: New Home TV Player System Using Lasers and Holography Sets Company in Race against CBS for $1-Billion Market." *Business Week*, 4 October 1969.

"Reading, Writing and Profit." *Business Week*, 4 October 1969.

Roberts, L. G. "Multiple Computer Networks and Intercomputer Communications." *Communications of the ACM*, vol. 11, no. 5, May 1968.

Roethlisberger, F. J. *Man-in-Organization*. Cambridge, Massachusetts: Harvard University Press, Belknap Press, 1968.

Rosove, P. E. *An Analysis of Possible Roles of Educators as Derived from a Contextual Map*. System Development Corporation, Report no. SP30888, March 1968.

Rosove, P. E. *Developing Computer-Based Information Systems*. New York: John Wiley and Sons, 1967.

Rossi, P. H. and Biddel, B. A. *The New Media in Education*. Chicago: Aldine Publishing Company, 1966.

Sage, David M. "Information Systems, a Brief Look into History." *Datamation*, November 1968.

"A Satellite That Talks Canadian." *Business Week*, 2 August 1969.

Sexton, Patricia C. *The American School, A Sociological Analysis*. Englewood Cliffs, New Jersey: Prentice-Hall, 1967.

Sielman, F. "Satellite Educational Television for Underdeveloped Countries." 19th Congress of the International Astronautical Federation, October 1968.

Silberman, C. E. "Technology Is Knocking at the Schoolhouse Door." *Fortune*, August 1966.

Simon, Herbert A. "Heuristic Problem Solving by Computer." In *Computer Augmentation of Human Reasoning*, edited by M. A. Sass and W. P. Wilkinson. Washington, D.C.: Spartan Books, 1965.

Simon, Herbert A. *The New Science of Management Decision*. New York: Harper and Row, 1960.

Sims, W. E. "Preview of 1979: Communications and the Computer." *Journal of Data Management*, September 1969.

Sisson, Roger. "Can We Model the Educational Process?" *Socioeconomic Planning Sciences*, April 1967.

Slaughter, Robert F. "The Role of Business in Achieving the Promise of Educational Technology." *American Association of College Teachers Yearbook* 20 (1967).

"Small Time-Sharing Series Suitable for Schools." *AEL*, September 1968.

Smith, S. L., and Goodwin, N. C. *Computer-Generated Speech and Man/Computer Action*. Bedford, Massachusetts: The MITRE Corporation, Report no. MTP-96, August 1969.

Solomon, M. D., Jr. "Are Free-Standing Computers *Really* Here to Stay?" *Datamation*, July 1966.

Sprague, R. E. *Electronic Business Systems*. New York: Ronald Press, 1962.

Sprague, R. E. "The Information Utilities." *Business Automation*, March 1965.

Steiner, G. A. *Top Management Planning*. London: Macmillan & Co., 1969.

Steinhardt, E. "Systems Engineering Study of a National Educational TV System." 19th Congress of the International Astronautical Federation, October 1968.

Summers, J. K. "A Distributed Data Processing System for On-Line Decision Making." In *Management Information Systems: Progress and Perspectives*, edited by C. H. Kriebel and R. L. Van Horn. Proceedings of a Symposium held at Carnegie-Mellon University, Pittsburgh, June 1968, forthcoming.

"The Time-Sharing Segment of the EDP Marketplace." *EDP Weekly*, 28 April 1969.

"Time-Sharing Services." *Modern Data*, July 1969.

"TV in a Cartridge Sparks 3-Way Tiff." *Business Week*, 22 November 1969.

U.S. Office of Education, Bureau of Elementary and Secondary Education. *Educational Engineering: Managing Environmental and Institutional Change to Increase Educational Productivity.* Washington, D.C.: January 1970.

Ware, W. H. *Computer in Your Future*. Santa Monica, California: The RAND Corporation, Report no. P3626, November 1967.

Ware, W. H. "Security and Privacy in Computer Systems." In *Proceedings of the Spring Joint Computer Conference*. Washington, D.C.: Thompson Book Co., 1967.

Ways, M. "The Road to 1977." *Fortune*, January 1967.

Weiner, Norbert. *God and Golam Inc.* Cambridge, Massachusetts: MIT Press, 1964.

Weiner, Norbert. *The Human Use of Human Beings*. Garden City, New York: Doubleday, 1954.

"When EDP Goes Back to the Experts." *Business Week*, 18 October 1969.

"Where the Action Is." *Electronics Business Week*, 4 October 1969.

Withington, Frederick G. *The Use of Computers in Business Organizations.* Reading, Massachusetts: Addison-Wesley Publishing Co., 1966.

Zani, R. L., and Zani, W. M. "Toward the Computer Utility: Evolution or Revolution?" *Datamation*, October 1969.

Supplementary Bibliography

COMPUTER APPLICATIONS IN EDUCATION

Adams, M. N. "Computer-Assisted Instruction." *Computers and Automation*, vol. 15, no. 3, 1966.

Alcorn, B. K. "A Proposal for a Total Information System for Educational Institutions." *Journal of Educational Data Processing* 3 (1966).

Allen, D. W. "Stanford's Computer System Gives Scheduling Freedom to 26 Districts." *Nation's Schools*, vol. 77, no. 3, 1966.

Almond. M. "An Algorithm for Constructing University Timetables." *The Computer Journal*, vol. 8, no. 4, 1966.

Ashby, W. R. "Computers and Decision Making." *New Scientist* 7 (1960).

Asher, J. W., and Kurfeest, M. "Computer and Information Retrieval—School Law: A Case Study." *Harvard Educational Review* 35 (1965).

Baker, F. B. "Computer Simulation of Cognitive Behavior." Paper read at Symposium, American Educational Research Association. New York: February 1964.

Baker, F. B. "Use of Computers in Educational Research: Non Computational Uses of Computers." *Review of Educational Research* 33 (1963).

Bessent, W. "A Feedback Procedure for Simulation of Administrative In-Basket Problems." Paper read at the American Educational Research Association National Convention. New York: February 1967.

Bitzer, D. L. *The Uses of Plato: A Computer-Controlled Teaching System*. Urbana, Illinois: University of Illinois, 1965. (See also *Audio-visual Instruction*, vol. 11, no. 1, 1966.)

Bogdanoff, E., and others. "Simulation: An Introduction to a New Technology." Santa Monica, California: System Development Corporation, Report no. TM-499, 1960.

Borko, H., ed. *Computer Applications in the Behavioral Sciences.* Englewood Cliffs, New Jersey: Prentice-Hall, 1962.

Bundy, R. F. "Computer-Assisted Instruction: Now and for the Future." *Audiovisual Instruction*, vol. 12, no. 4, 1967.

Bushnell, D. D., ed. *The Automation of School Information.* Washington, D.C.: National Education Association, Department of Audiovisual Instruction, 1964.

Bushnell, D. D., ed. *Computer Application in Education.* Washington, D.C.: National Education Association, Technological Development Project, Monograph 62, 1963.

Bushnell, D. D. "The Future of the Computer in Educational Systems." *AV Communication Review* 11 (1963).

Bushnell, D. D., and Allen, D. W., eds. *The Computer in American Education.* New York: John Wiley and Sons, 1967.

Bushnell, D. D., and Cogswell, J. F. "A Computer-Based Laboratory for Automation in School Systems." *AV Communication Review* 9 (1961).

Caffrey, J., and Mosmann, C. J. *Computers on Campus.* American Council on Education, 1967.

"California Computer Teaches Arithmetic to School Children in Kentucky." *Computers and Automation*, vol. 16, no. 5, 1967.

Carroll, J. B., and Ellis, A. B. *Planning and Utilization of a Regional Data Bank for Educational Research Purposes.* Cambridge, Massachusetts: Laboratory for Research in Instruction, Graduate School of Education, Harvard University, 1965.

Carter, L. F. "Automation and Education." Santa Monica, California: System Development Corporation, Report no. SP-529/001/00, 1962.

Carter, L. F. "The System Approach, Technology and the School." Santa Monica, California: System Development Corporation, 1965. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 614 698).

Cogswell, J. F., and others. "New Solutions to Implementing Instructional Media through Analysis and Simulation of School Organization." Santa Monica, California: System Development Corporation, Report no. TM-1809, March 1964.

Cogswell, J. F., and others. "A Computer Simulation Vehicle for Educational Systems." In *Computer Concepts and Educational Administration*, edited by Robert W. Marker and others. Iowa City, Iowa: Iowa University, Iowa Educational Information Center, 1966.

Coleman, J. S. "Analysis of Social Structures and Simulation of Social Processes with Electronic Computers." In *Simulation in Social Science: Readings*, edited by H. Guetzkow. Englewood Cliffs, New Jersey: Prentice-Hall, 1962.

"Computer Aids Schools in New Project." *Educational Technology*, vol. 7, no. 4, 1967.

"Computer Feasibility Studies Begin." *Educational Technology*, vol. 7, no. 11, 1967.

"A Computer and Vocational Guidance." *Educational Technology*, vol. 7, no. 12, 1967.

Cooley, W. W. "A Computer Measurement System for Guidance." *Harvard Educational Review* 34 (1964).

Coulson, J. E. "Automation, Cybernetics, and Education." Santa Monica, California: System Development Corporation, 1965. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 612 946).

Coulson, J. E., ed. *Programmed Learning and Computer-Based Instruction.* New York: John Wiley and Sons, 1962.

Cruickshank, D. R. "Simulation: New Direction in Teacher Preparation." *Phi Delta Kappan,* vol. 48, no. 1, Sept. 1966.

Culbertson, J. T., ed. *Simulation in Administrative Training.* Columbus, Ohio: University Council for Educational Administration, 1960.

"Curriculum Shopping Via Computer, TV Consoles." *Computers and Automation,* vol. 16, no. 2, 1967.

D'Antuono, A. "Constructing the Master Schedule by a Computer." *The Bulletin of the National Association of Secondary School Principals,* vol. 49, no. 303, 1965.

Davis, D. J., and Stolurow, L. M. *Computer-Based Systems: The New Research Aid.* Urbana, Illinois: The University of Illinois, 1964. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 608 686).

DeCecco, J. P. *Educational Technology.* New York: Holt, Rhinehart and Winston, 1964.

Douglas, W. A., and Hirt, D. C. "Computer Sectioning at the University of Colorado." *College and University,* vol. 42, no. 3, 1967.

Dunn, R. F. "More Than One Road to the Benefits of Educational Data Processing." *The American School Board Journal,* vol. 151, no. 4, 1965.

"Educational System of Future Recommended for the School District of Philadelphia." *Computers and Automation,* vol. 16, no. 5, 1967.

Egbert, R. L. *The Computer in Education: Malefactor or Benefactor.* Baltimore: Spartan Books, 1963.

Egbert, R. L., and Cogswell, J. F. "System Design for Continuous Progress School: Part I." Santa Monica, California: System Development Corporation, 1964. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 436 528).

Egbert, R. L., and Cogswell, J. F. "System Design for Continuous Progress School: Part II. Surveillance and Detection System." Santa Monica, California: System Development Corporation, 1964. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 436 531).

Egbert, R. L., and Cogswell, J. F. "System Design for Continuous Progress School: Part III. The Instructional Materials Center." Santa Monica, California: System Development Corporation, 1964. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 451 860).

Ellis, A. B. *The Advantages and Disadvantages of Regionalized Data Processing for Education.* Cambridge, Massachusetts: New England Education Data Systems, 1966.

Ellis, A. B. "Some Characteristics of Educational Data Banks." In *The Computer in American Education,* edited by D. D. Bushnell and D. W. Allen. New York: John Wiley and Sons, 1967.

Ellis, A. B., and Wetherell, C. S. *The Computer and Career Decisions.* Cambridge, Massachusetts. Harvard University, Information System

for Vocational Decisions, Technical Memorandum I, 1966.

Engel, G. L. *Computer-Assisted Instruction: A Selected Bibliography and KWIX Index.* U.S. Naval Weapons Laboratory. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 645 654).

Engvold, K. J., and Hughes, J. L. "A Model for a Multifunctional Teaching System." *Communications of the ACM*, vol. 10, no. 6, 1967.

Eraut, M. R. "An Instructional Systems Approach to Course Development." *AV Communication Review*, vol. 15, no. 1 ,1967.

Evans, L. H. "The Challenge of Automation of Education." *American Behavioral Scientist*, vol. 6, no. 3, 1962.

Evans, L. H., and Arnsten, G. E. *Automation and the Challenge to Education.* Washington, D.C.: National Education Association, 1962.

Fattu, N. A., and Elam, S., eds. *Simulation Models for Education.* Bloomington, Indiana: The Fourth Annual Phi Delta Kappa Symposium on Educational Research, 1965.

Faulkner, H. "Computer Sectioning and Class Scheduling." *Datamation*, vol. 11, no. 6, 1965.

Feingold, S. L., and Frye, C. H. "*User's Guide to PLANIT (Programming Language for Interactive Teaching).*" Santa Monica, California: System Development Corporation, Report no. TM-3055/000/00, 1966.

Feurzeig, W. *New Educational Potentials of Information Technology.* Cambridge, Massachusetts: Bolt, Beranek and Newman, 1967.

Feurzeig, W. "Towards More Versatile Teaching Machines." *Computers and Automation*, vol. 14, no. 3, 1965.

Filep, R. T. "Individualized Instruction and the Computer: Potential for Mass Education." *AV Communication Review*, vol. 15, no.1, 1967.

Frederiksen, N. "Basket Tests and Factors in Administrative Performance." In *Simulation in Social Science: Readings*, edited by H. Guetzkow. Englewood Cliffs, New Jersey: Prentice-Hall, 1962.

Friesen, D. D. "The Validation of an Automated Counseling System." Santa Monica, California: System Development Corporation, 1965. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 620 663).

Fuller, R. *Education Automation: Freeing the Scholar to Return to His Studies.* Carbondale, Illinois: Southern Illinois Press, 1963.

Fund for the Advancement of Education, *The Computer in American Education: Issues and Applications.* Palo Alto, California: 1965.

Gentile, R. J. "The First Generation of Computer-Assisted Instructional Systems: An Evaluative Review." *AV Communication Review*, vol. 15, no. 1, 1967.

George, F. H. "Inductive Machines and the Problem on Learning." *Cybernetica*, 2 (1959).

Gerard, Ralph W., ed. *Computers and Education.* New York: McGraw-Hill, 1967.

Goldberg, A., and Cymbala, R. J. "EDP in Education." *Audiovisual Instruction*, vol. 12, no. 4, 1967.

Goldberg, A.; Tondow, M.; and Bushnell, D. D. "The Computer in Education—Some Examples." *IEEE Procedures*, vol. 54, no. 12, 1966.

Goodlad, John I.; O'Toole, John F., Jr.; and Tyler, Louise L. *Computers and Information Systems in Education*. New York: Harcourt, Brace and World, Inc., 1966.

Goodman, Edith H., ed. *Automated Education Handbook*. Detroit: Automated Education Center, 1965.

Goodman, F. L. "The School Information Center." *NEA Journal*, vol. 56, no. 2, 1967.

Grant, C. B. S. "Educational Technology in the Nation's High Schools, a Status Report." *Data Processing Magazine*, vol. 9, no. 8, 1967.

Grant, C. B. S. "Needed, a National Educational Data Center." *Data Processing Magazine*, vol. 9, no. 3, 1967.

Greenberger, M., ed. *Computers and the World of the Future*. Cambridge, Massachusetts: MIT Press, 1962.

Greenberger, M. *Management and the Computer of the Future*. New York: John Wiley and Sons, 1962.

Greenlaw, P. S.; Herron, L. W.; and Rawdon, R. H. *Business Simulation in Industrial and University Education*. Englewood Cliffs, New Jersey: Prentice-Hall, 1962.

Grossman, A. "The California Educational Information System." *Datamation*, vol. 13, no. 3, 1967.

Grossman, A., and Howe, R. L. *Data Processing for Educators*. Chicago: Educational Methods, Inc., 1965.

Gullahorn, J. T., and Gullahorn, Jeanne E. "A Computer Model of Elementary Social Behavior." In *Computers and Thought*, edited by E. A. Feigenbaum and J. Feldman. New York: McGraw-Hill, 1963.

Haga, Enoch, ed. *Automated Educational Systems*. Elmhurst, Illinois: The Business Press, 1967.

Hall, J. A. P., ed. *Computers in Education*. Oxford, England: Pergamon Press, 1962.

Hansen, D. N. "Computer Assistance with the Educational Process." *Review of Educational Research* 36 (1966).

Harnack, R. S. "Teacher Decision Making and Computer-Based Resource Units." *Audiovisual Instruction*, vol. 12, no. 1, 1967.

Harvard Business Review (reprints from), *Computer Management Series*. Cambridge, Massachusetts: Harvard Press, 1967.

Harvard Business Review (reprints from), *Management Information Series*. Cambridge, Massachusetts: Harvard Press, 1967.

Haussmann, R. D., and Rath, G. J. "Automatic Teacher Assignment—A GPSS Simulation." *Journal of Educational Data Processing*, vol. 3, no. 1, 1965.

Henderson, C. R. "Pupil Transportation Procedures in a Mechanized System." *Journal of Educational Data Processing*, vol. 3, no. 3, 1965.

Hickey, A. E. *Computer-Assisted Instruction, a Survey of the Literature*. Newburyport, Massachusetts: Entelek, Inc., 1966. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 628 953).

Hollitch, R. S., and Mittman B., eds. *Computer Applications*. New York: Macmillan, 1962.

Herbert, Evan. "A Special Report on Technology for Education." *International Science and Technology*, August 1967.

IBM Corporation. *IBM Annual Report.* Yorkville, New York: 1966.

Kaimann, R. A. "Educators and PERT." *Journal of Educational Data Processing* 3 (Winter 1965-1966).

Kaimann, R. A., and Marker, R. W. *Educational Data Processing: New Dimensions and Prospects.* Boston: Houghton-Mifflin, 1967.

Keenan, T. A. "Computers and Education." *Communications of the ACM* 7 (1964).

Kemeny, J. G., and Tribus, M. "The Dartmouth Time-Sharing System." *Journal of Engineering Education*, vol. 56, no. 8, 1966.

Kersh, B. Y. "The Classroom Simulator: An Audiovisual Environment for Practice Teaching." *Audiovisual Instruction* 6 (1961).

Leonard, C. R. *The Problem of Student Descriptive Scales and the NEEDS Approach to Solving the Data Collection and Report Generating Problems Using the IBM 1401 Computer.* New England Education Data Systems, 1966.

Leonard, J. M., and Wing, R. L. "Advantages of Using a Computer in Some Kinds of Educational Games." *Transactions on Human Factors in Electronics*, vol. HFE-8, no. 2, June 1967.

Licklider, J. C. R. "Preliminary Experiments in Computer-Aided Teaching." In *Programmed Learning and Computer-Based Instruction*, edited by J. Coulson. New York: John Wiley and Sons, 1962.

Licklider, J. C. R., and Clark, W. E. "On-Line Man-Computer Communication." *AFIPS Conference Proceedings, 1962 Spring Joint Computer Conference*, vol. 21. San Francisco: AFIPS, 1962.

Loughary, J. W. "The Computer-Assisted Counselor." *NEA Journal*, vol. 56, no. 2, 1967.

Loughary, J. W. *Man-Machine Systems in Education.* New York: Harper and Row, 1966.

Loughary, J. W., and Friesen, D. "AUTOCOUN: A Computer-Based Automated Counseling Simulation System." *Personality and Guidance Journal*, vol. 45, no. 1, 1966.

McCann, G. D., Herbert, K. J., and Ray, C. B. "An Integrated Computer System Concept for Research and Education." *International Computation Centre Bulletin* 3 (1964).

Macon, E., and Walker, E. E. "A Monte Carlo Algorithm for Assigning Students to Classes." *Communications of the ACM*, vol. 9, no. 4, 1966.

Martin, J. H. "Using the Computerized Tpewriter for Early Reading Instruction." *Audiovisual Instruction*, vol. 10, no. 4, 1965.

Michael, D. "Cybernation and Changing Goals in Education." In *The Computer in American Education*, edited by D. D. Bushnell and D. W. Allen. New York: John Wiley and Sons, 1967.

Morse, D., and Warner, A., eds. *Technological Innovation and Society.* New York: Columbia University Press, 1966.

Murphy, Judith. *School Scheduling by Computer: The Story of GASP.* New York: Educational Facilities Laboratory, 1964.

Newell, A., and Simon, H. A. "Computer Simulation of Human Thinking." *Science* 134 (1961).

Newell, A., and Simon, H. A. "GPS: A Program that Simulates Human Thought." *Procedures of the Conference for Learning Automation.* Oldenbourg, Munich: 1961. Reprinted in *Computers and Thought*,

edited by E. A. Feigenbaum and J. Feldman. New York: McGraw-Hill, 1963.

Oettinger, A. G. *Automatic Language Translation*. Cambridge, Massachusetts: Harvard University Press, 1960.

Oettinger, A. G. "Programming a Digital Computer to Learn." *Philosophical Magazine* 43 (1952).

Oettinger, A. G. *Technological Aids to Creative Thinking (Project TACT)*. Cambridge, Massachusetts: Harvard University, The Computation Lab., 1966.

Oettinger, A. G. "A Vision of Technology and Education." *Communications of the ACM* 9 (1966).

Prince, T. R. *Information Systems for Management Planning and Control*. Homewood, Illinois: R. D. Irwin, 1966.

"Problem: Reaching the Student Who Won't Learn." *School Management*, vol. 11, no. 3, 1967.

"RCA to Supply Computerized Education in New York City." *Data Processing Magazine*, vol. 9, no. 8, 1967.

Ransom, C. E., Jr. "Computers and Education—The IBM Approach." *Computers and Automation*, vol. 16, no. 3, 1966.

Richardson, J. O. "Teaching Mathematics Using a Time-Shared Computer System." *Computers and Automation*, vol. 15, no 3, 1966.

Ridgeway, J. "Computer-Tutor: Competition for Public Education." *Education Digest*, vol. 32, no. 1, 1966.

Rogers, J. L. "Current Problems in CAI." *Datamation*, vol. 14, no. 9, 1968.

Rogers, J., and Cook, D. "The Computer and the School of Tomorrow." *Datamation*, vol. 12, no. 5, 1966.

Rosenberg, R. C. *Computer-Aided Teaching of Dynamic System Behavior*. Cambridge, Massachusetts: M.I.T. (Available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 640 681).

Rosove, Perry E. "Toward Education in Real Time." *Procedures of the Fall Joint Computer Conference*, 1968.

Rowan, T. C. "Remote Computer Usage: Implications for Education." Santa Monica, California: System Development Corporation, 1965. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 610 698).

Ryans, D. G. "Looking to the Future in Education." *Education Recaps* 44 (1963).

Sass, M. A., and Wilkinson, W. *Symposium on Computer Augmentation of Human Reasoning*. Washington, D.C.: Spartan Book, Inc., 1965.

Schwartz, H. A., and Long, H. S. "Instruction by Computer." *Datamation*, vol. 12, no. 9, 1966.

Seaman, J. P. "Computer Speeds Data Flow." *Minnesota Journal of Education*, vol. 47, no. 8, 1967.

Shutt, B. T. "Indiana University Goes to Computer-Based Admissions." *College and University*, vol. 42, no. 2, 1967.

Silberman, C. E. "The Remaking of American Education." *Fortune*, vol. 63, no. 4, 1961.

Silberman, C. E. "Technology is Knocking at the Schoolhouse Door." *Fortune*, vol. 74, no. 3, 1966.

Silberman, H. F. "Characteristics of Some Recent Studies of Instructional Methods." In *Programmed Learning and Computer-Based Instruction*, edited by J. E. Coulson. New York: John Wiley and Sons, 1962.

Silberman, H. F. "The Digital Computer in Education." *Phi Delta Kappan* 43 (1962).

Silberman, H. F. "Using Computers in Education: Some Problems and Solutions." *Educational Leadership*, vol. 24, no. 7, 1967.

Silberman, H. F. "What Are the Limits of Programmed Instruction." *Phi Delta Kappan* 44 (1963).

Silberman, H. F., and Coulson, J. E. "The Teaching Machine as an Educational Technique." In *Computer Applications in the Behavioral Sciences*, edited by H. Borko. Englewood Cliffs, New Jersey: Prentice-Hall, 1962.

Silvern, G. K., and Silvern, L. C. "Programmed Instruction and Computer-Assisted Instruction—An Overview." *IEEE Proceedings*, vol. 54, no. 12, 1966.

Simon, H. A. *The Shape of Automation: For Men and Management.* New York: Harper and Row, 1965.

Skinner, B. F. *The Technology of Teaching.* New York: Appleton-Century-Crofts, Inc., 1968.

Slamecka, V., ed. *The Coming Age of Automation.* Bethesda, Maryland: Documentation, Inc., 1965.

Smith, G. R. "Computer Program Sketches Curriculum Design." *Elementary School Journal* 63 (1963).

Smith, K., and Smith, M. *Cybernetic Principles of Learning and Educational Design.* New York: Holt, Rhinehart and Winston, 1966.

Starkweather, W. C. *An Admissions Data Processing System: Handling Student Applications at the University of Massachusetts.* Amherst, Massachusetts: University of Massachusetts, Office of Institutional Studies, Report no. 10, 1964.

Starkweather, W. C. *General Information Manual: Rolling Admissions Data Processing System.* Amherst, Massachusetts: University of Massachusetts, 1966.

Sternlicht, F. R., and Rowan, T. C. "Computer Technology and Applications to Education." Santa Monica, California: System Development Corporation, 1964. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 611 057).

Suppes, P. "Computer-Based Mathematics Instruction. Annual Report" (unpublished). Stanford, California: Stanford University, Institute for Mathematical Studies in the Social Sciences, 1966.

Suppes, P. "On Using Computers to Individualize Instruction." Position Paper for the AEDS-Stanford School of Education Conference, 1965.

Suppes, P. "The Teacher and Computer-Assisted Instruction." *NEA Journal*, vol. 56, no. 2, 1967.

Suppes, P. "The Uses of Computers in Education." *Scientific American*, vol. 215, no. 3, 1966.

Suppes, P., and others. "Arithmetic Drills and Review on a Computer-Based Teletype." *Arithmetic Teacher* 13 (1966).

Swanson, D. R. "Searching Natural Language Text by Computer." *Science* 132 (1960).

Taft, M. I., and Reisman, A. "Toward Better Curriculum through Computer Selected Sequencing of Subject Matter." *Management Science*, vol. 13, no. 11, 1967.

Teichroew, D. *Computers and Universities.* Case Institute of Technology: Division of Organizational Sciences, Working Paper No. 4, 1967.

Thompson, O. E. *A Method for Scheduling Students to Classes.* Pittsburgh: Carnegie Institute of Technology, 1965. (Also available from FSTI Clearinghouse; Springfield, Va. 22151; under AD 620 174).

Tomkins, S. S. *Computer Simulation of Personality.* New York: John Wiley and Sons, 1963.

Turing, A. M. "Computing Machinery and Intelligence." *Mind* 59 (1950).

University of Texas. *Coursewriter I, Author's Manual.* Austin, Texas: 1966.

Weinberger, M. J. "The Use of Simulation in the Teaching of School Administration." Ph.D. dissertation, Columbia University, Teachers College, 1965. Unpublished. (Available from University Microfilms, Inc.; Ann Arbor, Michigan 48103; Order No. 66-6561).

Weizenbaum, J. *Contextual Understanding by Computers.* Cambridge, Massachusetts: M.I.T., 1966.

Whitlock, J. W. *Automatic Data Processing in Education.* New York: John Wiley and Sons, 1964.

Wright, G. *A Selected Annotated Bibliography on Educational Systems.* Case Institute of Technology, Division of Organizational Sciences, Working Paper No. 1, 1966.

Wynn, R. "Simulation: Terrible Reality in the Preparation of School Administrators." *Phi Delta Kappan* 46 (1964).

Yovits, M.; Jacobi, G. T.; and Goldstein, G. D., eds. *Self Organizing Systems—1962.* Washington, D.C.: Spartan Books, 1962.

Zant, W. M. "Campus Computer Helps Students Do Their Homework at Dartmouth." *Electronics*, vol. 38, no. 24, 1965.

Zimmerman, W. S. "Implications of the Computer for Creativity." *Educational Psychology Measurement* 24 (1964).

Zinn, Karl L. "Instructional Uses of Interactive Computer Systems." *Datamation*, vol. 14, no. 9, 1968.

Acknowledgments

JOHN A. EVANS:

The author acknowledges the numerous technical insights provided by my colleagues, especially at the MITRE Corporation, Carnegie-Mellon University, the Rand Corporation, the System Development Corporation, and the Institute for Social Research at the University of Michigan. In addition, I wish to thank the U.S. Office of Education, Operation PEP, and various superintendents of California and Massachusetts school systems through whom I have acquired a rich understanding of educational problems. The experience gained while serving on USOE's Task Force on Secondary and Elementary Education and as a consultant to Operation PEP has been invaluable in shaping my thoughts in regard to the potential and limitations of information technology for educational administrators. I also would like to thank Patricia J. Chatta for her assistance in researching the literature and in structuring and writing the paper.

ROGER A. KAUFMAN:

The author acknowledges the assistance of Robert E. Corrigan who helped me to think out a number of subjects; Donald W. Johnson who did his best to teach me about the realities of operational education; J C Fikes who keeps reminding me that people come first; and several colleagues who reviewed this evolving document and made suggestions for its improvement.

RICHARD C. WILLIAMS:

The author acknowledges the assistance of James Quinn in the preparation of this manuscript.

casea

Monograph No. 22